Mellanox Grid Director 4700

Installation Manual

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Preface

About this Manual

This manual provides installation instructions for the Mellanox Grid Director™ 4700 40Gb/s InfiniBand Switch, the product specifications, unpacking and installation information, unit power up, and initiation and troubleshooting procedures.

Refer to the official and latest product release notes for last-minute updates.

Technical support may be obtained directly from:

- Your regional distributor from whom this product was ordered
- Your OEM customer representative

For further information and assistance, go to http://www.mellanox.com/content/pages.php?pg=support_index.

Audience

The manual is intended primarily for system administrators who are authorized to install a Grid Director 4700 switch.

It is assumed that the readers are familiar with the InfiniBand technology and terminology.

Related Documentation

For additional information, refer to the following documents:

- Grid Director Family Getting Started Guide [LIT-00037]
- Grid Director Family User Manual [DOC-00785]
- Grid Director Family Release Notes [DOC-00962]
- Regulatory and Compliance Reference Guide [DOC-00859]

Document Conventions

The following lists conventions used in this document.

NOTE: Identifies important information that contains helpful suggestions.

CAUTION: Alerts you to the risk of personal injury, system damage, or loss of data.

WARNING: Warns you that failure to take or avoid a specific action might result in personal injury or a malfunction of the hardware or software. Be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents before you work on any equipment.

Typography

The following table describes typographical conventions in Mellanox documentation. All terms refer to isolated terms within body text or regular table text unless otherwise mentioned in the Notes column.

Term, Construct, Text Block	Example	Notes
File name, pathname	*/opt/ufm/conf/gv.cfg*	
Console session (code)	`-> flashClear <CR>`	Complete sample line or block. Comprises both input and output. The code can also be shaded.
Linux shell prompt	`#`	The "#"character stands for the Linux shell prompt.
Mellanox CLI Guest Mode	`Switch >`	Mellanox CLI Guest Mode.
Mellanox CLI admin mode	`Switch #`	Mellanox CLI admin mode
String	`< > or []`	Strings in < > or [ ] are descriptions of what will actually be shown on the screen, for example, the contents of <your ip> could be 192.168.1.1
Management GUI label, item name	**New Network,** **New Environment**	Management GUI labels and item names appear in bold, whether or not the name is explicitly displayed (for example, buttons and icons).
User text entered into Manager, e.g., to assign as the name of a logical object	**"Env1", "Network1"**	Note the quotes. The text entered does not include the quotes.

1 Introduction

This chapter provides a description of the Mellanox Grid Director 4700 chassis and its system boards.

1.1 Mellanox Grid Director™ 4700 Overview

Mellanox's fourth-generation Grid Director™ 4000 series of smart switches addresses the growing size and complexity of clusters by providing high interconnect bandwidth, advanced carrier-class management and a unique HyperScale™ stackable architecture.

The Grid Director™ 4700 is a high performance, ultra low latency and fully non-blocking InfiniBand switch for high performance clusters. With configurations of up to 324 ports or double-sided 648 ports of 40 Gb/s per port InfiniBand connectivity, the Grid Director 4700 delivers an impressive 51.8 Tb/s of non-blocking bandwidth with between 100 and 300 nanoseconds of port-to-port latency. Additionally the switch's 648 ports can be divided between two racks for weight distribution and greater ease of cabling.

The switch's HyperScale architecture provides a unique inter-switch link capability for stacking multiples of 324 ports to form highly scalable, cost effective, and low latency fabrics. As a result, I/O bottlenecks are removed, allowing applications to operate at maximum efficiency. As the industry's largest QDR switching solution, the efficient Grid Director 4700's smart design provides unprecedented levels of performance and makes it easy to build clusters that can scale out to thousands of nodes.

Figure 1: Grid Director 4700 with Standard Fabric Boards – Front

Figure 2: Grid Director 4700 with HyperScale Fabric Boards – Front

Figure 3: Grid Director 4700 – Rear

1.2 Main Features

- Ultra-low latency: between 100 and 300 nanoseconds port-to-port
- 324 QDR (40Gb/s) auto-negotiating QSFP InfiniBand ports in a 19U switch
- 648 port option can be divided between two racks for weight distribution and greater ease of cabling
- Unique HyperScale™ architecture allows scaling to thousands of nodes with a single tier of switches (under 400 nanoseconds of latency)
- Available bandwidth: up to 51.8 Tbps of non-blocking bandwidth
- Simple and fast device management
- Fully managed by Mellanox Unified Fabric Manager (UFM)

- Support for longer and more varied cable options
- Zero down time with no single point of failure and real-time fault notifications
- QSFP ports supporting either copper or optical cables
- Redundant, hot-swappable Management Boards, power supplies, and fans meet stringent availability requirements
- InfiniBand specification 1.2 compliant

1.3 Product Architecture

The Mellanox Grid Director 4700 is a modular, rack-mountable chassis for a wide range of applications. Highlights of the Grid Director 4700 architecture include:

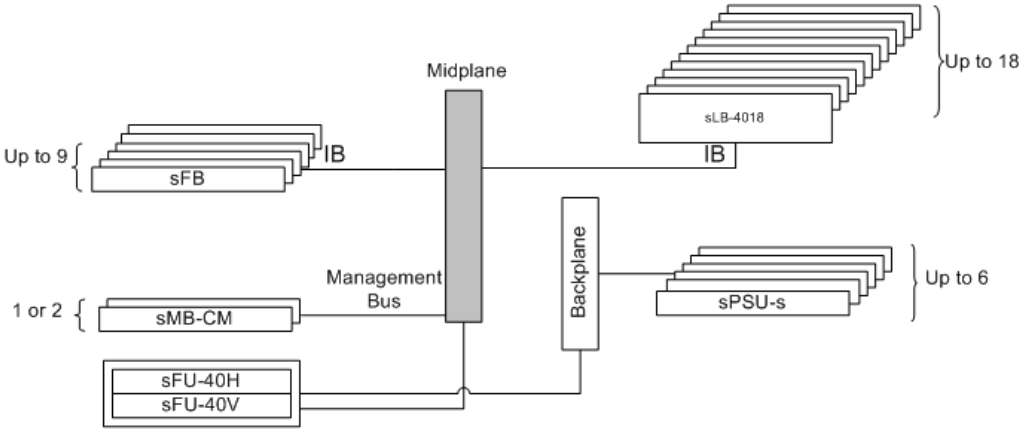
- Up to eighteen (18) line boards with 18 QSFP InfiniBand QSFP external interfaces and 18 QSFP InfiniBand links for connectivity between the Line cards and the internal Switch fabric
- Supports up to nine vertical fabric boards
- Supports one or two redundant hot swappable Management Boards (sMB) for fabric management and chassis management; when two Management boards are installed, they support failover capabilities in the event of failure of one of the boards
- Up to 6 power supply units (sPSU-S) with N:1/N:N redundancy
- Front-to-rear air cooling system consisting of a horizontal fan unit (sFU-40H) and a vertical Fan Unit (sFU-40V) for the Grid Director 4700
- Cabling for InfiniBand, management, and power located at rear of chassis
- Local and remote management and provisioning using CLI (Command Line Interface).

1.3.1 Main Building Blocks

The Grid Director 4700 rear panel has 18 slots in which you can install the Line Boards (sLB-4018).

The following figure is a simplified functional block diagram of the Grid Director 4700 components.

Figure 4: 4700 Block Diagram



The main building blocks of the Grid Director 4700 chassis are listed and described in the following sections.

Grid Director Midplane

The Grid Director includes a passive Midplane that connects the InfiniBand differential signals, control signals and power between the different boards in the chassis. (Fabric Board signals are routed from the front of the chassis to the Midplane; Line Boards are routed from the rear of the chassis to the Midplane.) The Midplane is not field serviceable.

Line Boards

The rear side of the Grid Director 4700 can host up to up to eighteen 18-Port QDR (40Gbps) Line Boards (sLB-4018). Each line board has 18 external QSFP interfaces, and 18 internal 4X InfiniBand interfaces for connectivity between the Line cards and the Switch fabric. Line boards are installed at the rear of the chassis in a horizontal position.

Fabric Boards

The Grid Director 4700 supports up to nine Fabric Boards (sFB) that are installed at the front of the chassis.

324-port chassis: The sFB-4700 QDR Fabric Board is installed in a standard 324-port chassis, in a vertical position. Each sFB-4700 has 36 internal QSFP InfiniBand ports.

648-port chassis: The HyperScale Fabric Board is installed in a 648-port chassis in a vertical position. Each HyperScale Fabric Board has 36 internal QSFP InfiniBand ports and 12 external 12x InfiniBand ports with CXP connectors.

The Fabric Boards determine the total bandwidth of the switching Clos topology within the chassis.

Grid Director Power Backplane

The power supply unit (sPSU-S) and horizontal fan unit (sFU-40H) modules are connected to the system through the backplane, which provides the mechanical, control and electrical interface to the controllable AC/DC 48V power supplies. It allows electric current flow,

supplies power to the Midplane via a special power harness, and provides connectivity to the Midplane and the fan units (sFU-40H).

Air Flow Cooling System

The Grid Director 4700 uses front-to-back air flow cooling and provides full internal redundancy, monitored fans. Fan speed is dynamically controlled as a function of temperature.

The air cooling system includes a horizontal fan unit (sFU-40H), containing eight fans and A vertical fan unit (sFU-40V) containing five fans.

LED indicators on the horizontal fan unit sFU-40H provide an on-site report on the operating conditions of the air cooling system modules, and provide an alarm indicator in the event of a high temperature condition.

InfiniBand Switch Silicon Firmware

Each Line Board and Fabric Board incorporates InfiniBand 36-port switch (ASIC) devices with locally attached memory containing firmware that controls basic functionality of the devices. The firmware controls low level link and physical layers functionality and may be upgraded via Ethernet or RS-232 on the Management Board or in-band via any of the InfiniBand Line Board ports.

InfiniBand products are RoHS-6 compliant.

Management

The Grid Director 4700 provides a command line interface (CLI) interface for flexible access the switch comprehensive management capabilities.

Device Management (DM)

- Control a device (e.g., a switch) or a device cluster
- Remote management, upgrades, logs/alarms

Management Board

The Grid Director supports either one or two hot-swappable Management Boards.

Power Supplies (sPSU-S)

Mellanox Grid Director switches support multiple power supply modules (sPSU-S) configured in redundant, hot-swap, current sharing mode for N:1 or N:N redundancy, depending on the configuration, and suitable for 100-240 VAC mains voltage (auto-sense). The Grid Director supports up to six power supply modules.

1.3.2 Reset Buttons

In the rare event of a 4700 system lock-up, the Reset button can be used to reset the system.

The system has two Reset buttons: one is located on the front panel of the sFU-40H fan assembly horizontal fan unit, a second one is on the sMB-CM Management Board front panel.

Management Reset

To reset the Grid Director 4700, push any of the reset buttons using a thick wire or tip of a pen.

Pressing the Reset button for one second resets the sMB-CM Management Board only; pressing the Reset button for at least six seconds resets the entire chassis.

1.4 Management

The Grid Director 4700 includes smart device management that provides a simple interface for deploying, troubleshooting, maintaining and upgrading the switch. With a simple to use CLI interface, routine tasks such as monitoring the switch operation or upgrading software and firmware are made simple.

2 System Configurations

2.1 Configuration Summary

This section summarizes the configuration for the Grid Director 4700 modules.

2.1.1 Module Configuration per Chassis

The following table provides a comprehensive list of modules per chassis, as well as the maximum number of modules that can be installed in a 4700 system.

> Some of the components are provided with the basic configuration chassis. The cabling guide bracket kit (KIT-00022) for HyperScale Fabric Board (chassis with 648 ports) is optional.

Table 1: Module Configuration per Chassis

Module	Name	Description	Number of Modules per chassis
Line Board	sLB-4018	Includes 18 QSFP ports	Up to 18
Fabric Board	sFB-4700	Includes 36 internal ports	Up to 9
HyperScale Fabric Board	sFB-4700-2X	Includes 36 internal and 12 external CXP (12X) ports	Up to 9
Power Supply	sPSU-S	AC/DC Power supply	Up to 6
Vertical Fan Unit	sFU-40V	Vertical Fan Unit	1
Horizontal Fan Unit	sFU-40H	Horizontal Fan Unit	1
Management Board	sMB-CM	Chassis Management Board	Up to 2
Cable Management Right	N/A	Right cabling guide brackets for cable management	1 (right)
Cable Management Left	N/A	Left cabling guide brackets for cable management	1 (left)
Optional: cabling guide bracket kit for HyperScale Fabric Board	N/A	Optional: kit for 648 ports (must be ordered separately). Includes HyperScale cabling guide bracket and long 19" brackets	1

2.1.1.1 Summary of Cabling Management and Rail Kit

- Standard chassis configuration (324 ports):
  - Cable management (standard)
  - Rail kit
  - 19" bracket attached to the chassis
- HyperScale Fabric Board chassis configuration (648 ports):

- Cable management (standard)
- Rail kit
- 19" bracket attached to the chassis
- KIT-00022 includes 3 parts (must be purchased separately for the 648-port configuration):
  - 1 HyperScale cabling guide bracket
  - 2x bracket long
  - 8 screws

2.1.2 Specifications Summary

The following table summarizes the Grid Director 4700 specifications.

Table 2: Feature Summary Table

Feature	4700
Rack Height	19U
HyperScale Rack Height	20U
Rack Width	19"
Switch Type	Director
Backplane Bandwidth	51.8 Tbps
Line Board Slots	18
Fabric Board Slots	9
Max # of InfiniBand Ports	324 40 Gbps InfiniBand Ports Optional 648 40 Gbps InfiniBand Ports
Interface Type	QSFP 40 Gbps (QDR) QSFP ports with support for optical adapters and cables
Redundant Components	Power Supplies (sPSU-S) Management Boards (sMB-CM)
Embedded Chassis Management (CLI)	Yes

2.2 4700 Configuration and Part Numbers

The following table details the basic configuration of the 4700 chassis.

Table 3: 4700 Basic Configuration

Product Description	Product/Module Name	P/N
Grid Director 4700 18-Slot QDR Basic Configuration	Grid Director 4700	VLT-30040
sFB-4700 QDR Fabric Board	sFB-4700	VLT-30041
sFB-4700-2X QDR Fabric Board	sFB-4700-2X	VLT-30042

Product Description	Product/Module Name	P/N
sLB-4018 18-Port QDR Line Board	sLB-4018	VLT-30043
sMB-CM Chassis Management Board	sMB-CM	VLT-30044
sPSU-S 1.4KW AC Power Supply Module	sPSU-S	VLT-30046
sFU-40H Horizontal Fan Unit	sFU-40H	VLT-30047-F
sFU-40V Vertical Fan Unit	sFU-40V	VLT-30048-F

The above parts can be ordered separately. The following table provides the list of additional spare parts and accessories.

Table 4: Spare Parts and Accessories

Description	Comment	P/N
Cable Management Right	Delivered with the switch	KIT-00023
Cable Management Left		KIT-00024
Cabling guide bracket kit for HyperScale Fabric Board. It includes the following parts: • 2 x 19" Long bracket (MEC-00576) • Cable management for Spine in 648 configuration (MEC-00593) • Screws for assembly (380J30011)	Set must be ordered per chassis	KIT-00022

2.3 Switch Internal Topology

High performance computing clusters typically utilize Clos networks, sometimes referred to as "Fat Tree" or Constant Bisectional Bandwidth (CBB) networks, to construct large node count non-blocking configurations. A Clos network is a switch topology in which integrated non-blocking switch chips (crossbars) with a relatively low number of ports are used to build a non-blocking switch topology supporting a much larger number of endpoints.

The Grid Director 4700 features an internal Clos network with Line Boards as the edge (leaf) switches and Fabric Boards as the core (spine) switches. Each Line Board switch chip is connected to each switch chip on the Fabric Boards through one or more InfiniBand connections.

The path from one external port to another node may require three switch hops:

- Hop 1 at a Line Board
- Hop 2 at a Fabric Board
- Hop 3 at another Line Board.

2.3.1 HyperScale Fabric Boards

HyperScale™ is an interconnect technology, enabling large scale fabrics at reduced latency, cost and complexity. Mellanox HyperScale fabric cards have double the capacity of standard fabric cards, as well as external (12x) ports. This combination enables new, modular configurations that allow scaling to large fabric sizes with the minimum amount of ports and

cables wasted for inter-switch connectivity. HyperScale combines the best of Hypercube (price, simplicity, cabling) and Fat-tree (performance).

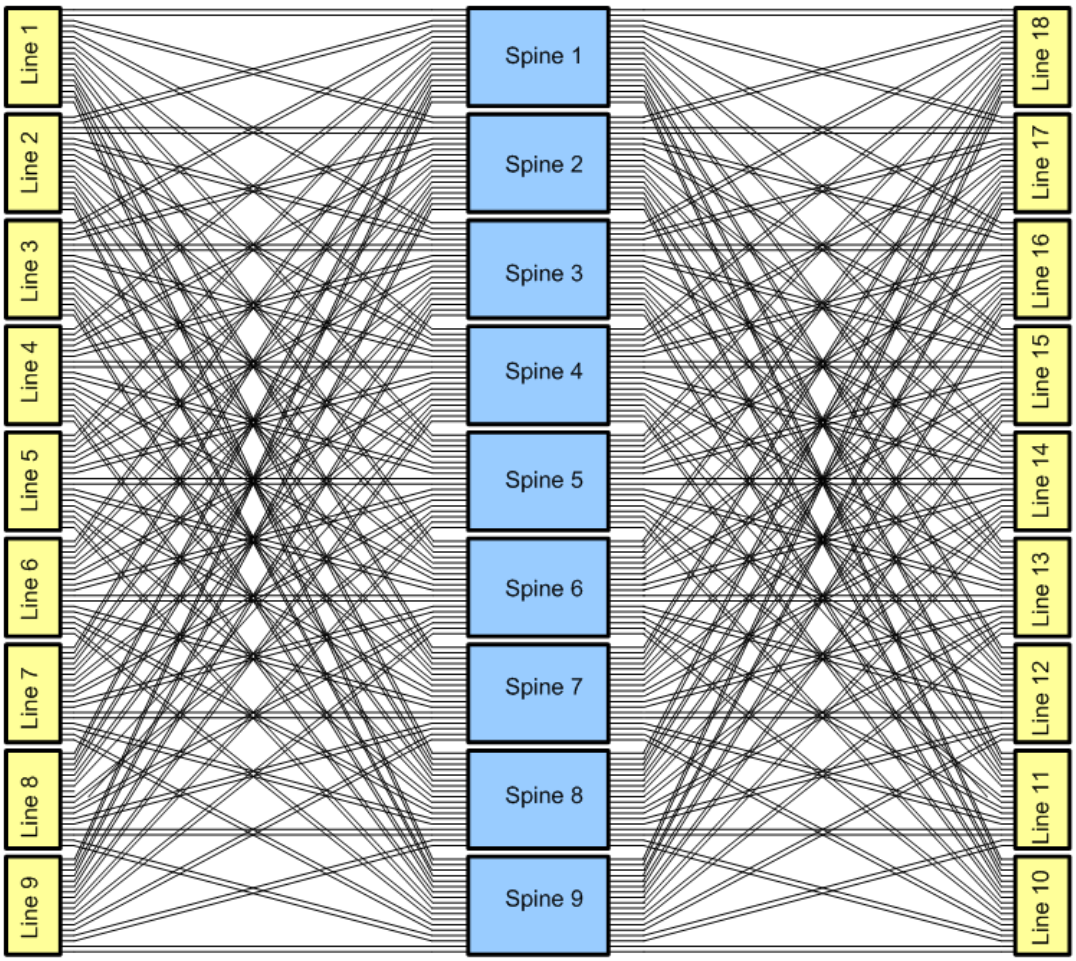
HyperScale features:

- Each 324 node scalable unit is fully independent (failures, upgrades)
- Lowest latency of 400 nanoseconds (vs. 500/750 nanoseconds)
- There are fewer cables to wire
- Ultimate application performance (large non-blocking islands and minimize application specific tuning/layout).

2.3.2 Switching Topologies

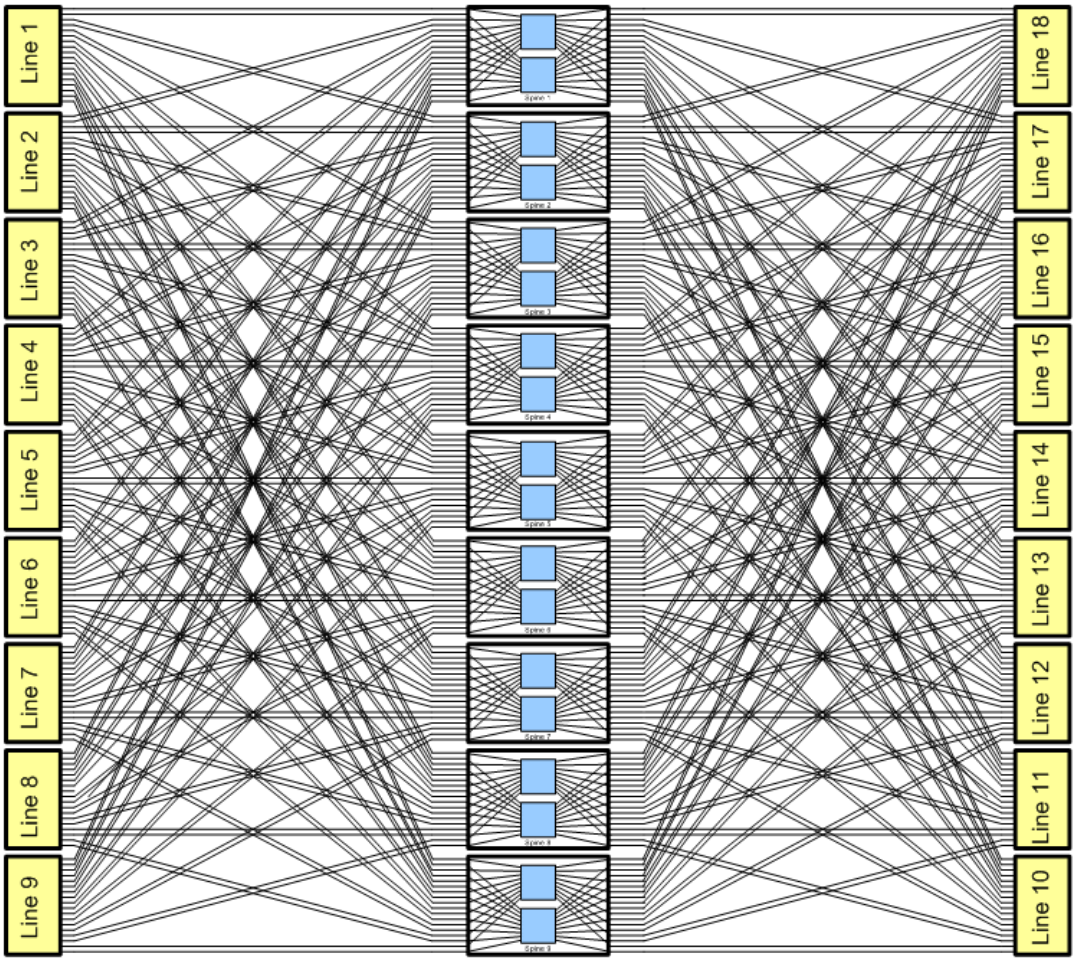
The following figure illustrates the Grid Director 4700 InfiniBand internal switching topology.

Figure 5: Grid Director 4700 Switching Topology



The following figure illustrates the Grid Director 4700 with HyperScale Fabric Board (spine) InfiniBand internal switching topology.

Figure 6: Grid Director 4700 HyperScale Spine Switching Topology



The Grid Director 4700 topology feature eighteen symmetrical Line Boards (sLB) and nine interconnect Fabric Boards (sFB).

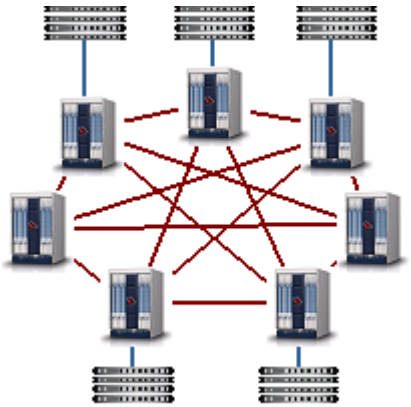
- Each Line Board (sLB-4018) includes one 36-port 40Gb/s InfiniBand switch chip.
- Each Fabric Board (sFB-4700) includes one 36-port 40Gb/s InfiniBand switch chip.
- Each HyperScale Fabric Board (sFB-4700-2X) includes two 36-port 40Gb/s InfiniBand switch chips.

The LEDs on the Fabric Board modules indicate proper connectivity and traffic flow between each line board and the respective fabric board.

2.3.3 HyperScale™ Configurations

HyperScale – Mesh Configuration

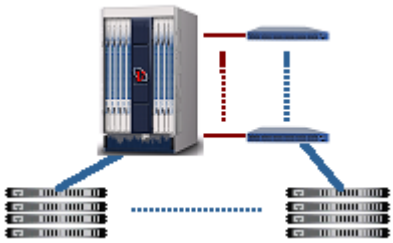
Figure 7: HyperScale – Mesh Configuration



- Multiple 4700 chassis can be connected in a mesh
- This configuration uses 4700 stacking fabric boards and 4700 switches
- Ideal for over 648 node counts
- CXP-CXP cables are used between switches

HyperScale – Edge Configuration

Figure 8: HyperScale – Edge Configuration



- Combines 4700 and 4036 switches
- CXP-3QSFP cables are used between switches
- Ideal for 324-648 node counts

3 4700 Specifications

3.1 4700 Architecture

- 9 slots of Fabric boards in front of the chassis
- 18 slots for Line Boards
- Based on passive Midplane board which allow the IB differential signals, control signals and power connectivity between the different boards in the chassis
- Cables for InfiniBand, management, and power all located at the rear
- Up to 324 InfiniBand QSFP (40 Gbps) ports
- Bisectional switch bandwidth (QDR): 51.8 Tbps

3.2 4700 Fabric Board (sFB-4700) Specifications

- Up to 9 hot-swappable Fabric Boards running at Quad Data Rate (QDR) which support the switching Clos topology
- Hot-swappable operation with no traffic disruptions
- On board high performance, low power CPU for low-level chassis management purposes
- EEPROMs to store the switch ASIC ERP (Embedded RISC processor) code
- Indicators: Physical connectivity and logical connectivity LEDs per Line Board link port, power, Rdy and Info LED.
- On-board temperature monitoring reported to Management system
- Thermal shutdown for over temperature sensing

3.3 4700 Line Board (sLB-4018) Specifications

- Up to 18 sLB-4018 hot-swappable Line Boards (sLB) running at 40 Gbps Quad Data Rate (QDR)
- 18 auto-sensing QSFP InfiniBand ports (40 Gbps)
- Hot-swappable operation with no traffic disruptions
- All ports support copper or optical cables
- Indicators: Physical connectivity and logical connectivity LEDs per port, power, Rdy and info LEDs
- On board high performance, low power CPU for low-level chassis management purposes
- On-board temperature monitoring reported to Management system
- Thermal shutdown for over temperature sensing
- Data throughput QDR - 2.88 Tbps

- Port-to-port Latency - Under 100 nanoseconds
- Data Virtual Lanes - 8
- Management Virtual Lanes - 1
- MTU - 4096 Bytes, max
- Maximum hops - 1 hop between ports on the same board. 3 hops between different Line Boards in the same chassis.

3.4 4700 Management Board (sMB-CM) Specifications

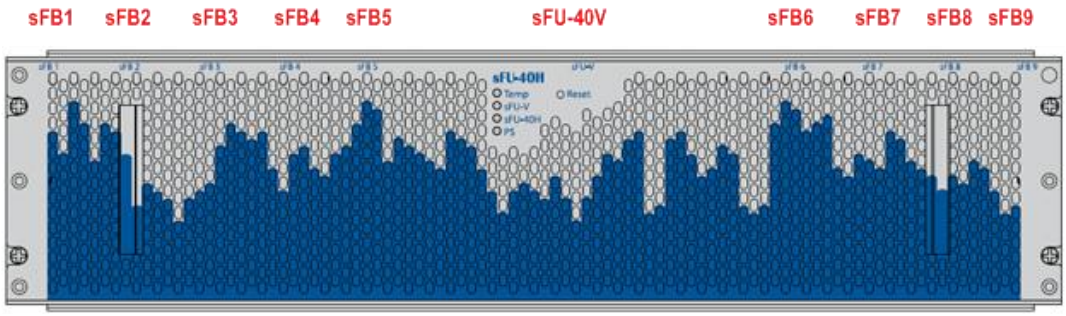
Two hot swappable Management Boards, each including on board CPU:

LEDs	Refer to LED Indicators (on page 31).
Connectors	10/100/1000 Ethernet RJ-45, EIA/TIA-232 Console RJ-45
Reset button	Resets the Management Board or the entire chassis.

3.5 Chassis Slot Numbering

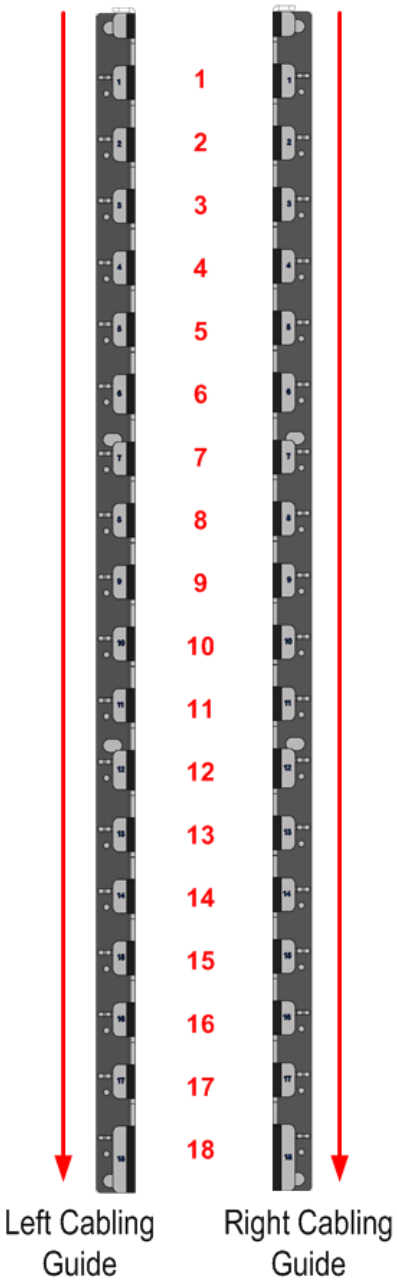
Slot numbering at the front of the chassis (for Management Board and Fabric Board) is from left to right (indication on the horizontal fan unit sFU-40H).

Figure 9: sFU-40H Horizontal Fan Unit



Slot numbering at the rear of the chassis (for Line Boards) is from top to bottom (indication on the cable guide brackets).

Figure 10: 4700 Line Board Slot Numbering



For specific instructions, refer to System Cabling (on page 77).

3.6 Torque Settings

Table 5: Torque Settings for Module Assembly

Assembly	Torque (in/lb)
sLB-4018 Line Board to chassis	2 (or use manual screwdriver)
sMB Management Board to chassis	2 (or use manual screwdriver)
Rail kit part A to part B	10
Rail to chassis	10

Assembly	Torque (in/lb)
Fabric Board to chassis	2 (or use manual screwdriver)

3.7 Module Configuration Rules

The Grid Director 4700 supports up to two Management Boards. Two Management Boards are used for redundancy/failover implementation. Use slot one (left) when only one Management Board is installed. For more information, refer to **Installing the Management Board (sMB-CM**).

The Grid Director 4700 supports any Fabric Board configuration (between 1 and 9). When installing the line boards, start at the bottom of the chassis. For more information, refer to **Installing the Line Board (sLB-4018**.

3.8 Clearance Requirements

Table 6: Clearance Requirements

Area	Recommended Minimum Clearance
Front of the rack	36" (90 cm) for technician access and maintenance
Rear side of the rack	24" (60 cm) for human accessibility
Sides of the rack	No limits
Space below the chassis	No limits
Space on top of the chassis	No limits

3.9 Power Data

3.9.1 Type of Power Cord on the Power Supply

Mellanox provides a 15 Amp cord (2 meter jumper), with a universal plug for a power distribution unit (PDU) for each power supply. The cord is detachable from the Mellanox 4700 chassis/power supply. Cable wiring: 3x14AWG.

3.9.2 Power Requirements

Table 7: 4700 Power Requirements

Power supply modules (sPSU-S) with N:1 or N:N redundancy. Note: Each power supply has its own power cord.	Up to 6 power supplies
Electrical rating	100–120/200–240V, 50–60Hz, 60A 12/8A per power feed MAX
Typical power consumption (QDR full configuration)	4000 Watt
Leakage current @254 V [mA]:	>6mA RMS (Note that leakage exceeds 3.5 mA when more than one power supply is being used)

Indicators	Operational AC and DC Status LEDs
Operating voltage	100–240 VAC, 50–60 Hz auto-sensing
Power factor	0.98 typical at 230Vac, full load 0.98 typical at 115Vac, full load
Temperature rating	0–45 degrees Centigrade

3.9.3 Power Characteristics

Table 8: Power Characteristics

Attribute	Specification	Comments
Power Entry	54–90 Volts, 47–63 Hz, auto-sensing	
Power Rating	1400 Watts @ 220V per module 1200 Watts @ 110V per module	
Nameplate Power Rating (VA)	Input: 100V–240Vac @ 16A; Output: 48Vdc @ 29A	
Nameplate Power Rating at 100V	12 A	
Nameplate Power Rating at 200V	8 A	
Power Factor (W/VA)	0.98 typical at 230 Vac, full load; 0.98 typical at 115 Vac, full load	Watts = Volts x Amps x Power Factor
Power supply efficiency	89% typical at 230Vac, full load rated power; 85% typical at 115Vac, full load rated power	A measure of the ability of the power supply to convert source AC power into usable DC power

3.9.4 Power Data per Module

Table 9: Power Data by Module

Module Name	Module	Watts / Module	Configured Qty	Total Watts
Fan Tray	sFU-40H	380	1	380
Fan Tray	sFU-40V	250	1	250
Management Board	sMB-CM	45	2	90
18-port Line Board	sLB-4018	110	18	1980
Fabric Board	sFB-4700	110	9	990
HyperScale Fabric Board	sFB-4700-X2	210	9	1890

3.9.4.1 Calculating the Required Number of sPSU-S Power Supply Modules

To find the minimum number of power supply modules required for a given switch configuration:

1. Add-up all DC power consumption numbers according to the built configuration.
2. Increase the number of sPSU-S modules according to redundancy requirements. A single sPSU-S unit provides up 1400 Watts.

This formula provides margin for momentary power peaks and enhances reliability by preventing the power subsystem from continuously operating at maximum power.

3. For redundancy (N:1 or N:N), configure additional power supplies.

Table 10: Module Power Data

Mellanox Grid Director™ 4700		
Description	**Module Name**	**DC Power Consumption [Watt] (*)**
Basic chassis configuration Single management board Horizontal fan units Vertical fan unit Two power supply units	4700 sMB sFU-40H sFU-40V 2 x sPSU-S	675.0
sFB, 9-QDR-connections fabric board	sFB	990.0
sMB	sMB-CM	45.0

Modules for the Mellanox Grid Director™ 4700		
Description	**Module Name**	**DC Power Consumption [Watt]**
sLB-4018, 18 QSFP ports per sLB-4018	sLB-4018	110.0
(*) Add 1.5 Watts for each connected QSFP optical module		

Spare Parts for the Mellanox Grid Director™ 4700		
Description	**Module Name**	**DC Power Consumption [Watt]**
sFU-40H, Horizontal Fan Unit	sFU-40H	380.0
sFU-40V, Vertical Fan Unit	sFU-40V	250.0

3.10 Calculating Heat Output in BTUs

To compute the approximate BTUs for a given configuration, find the power consumption in Watts (e.g., from Power Data Per Module; **see**), and multiply by 3.408. Example calculations for specific configurations are shown in the following table.

Table 11: BTUs for QDR Sample Configurations

Configuration	**Modules Included**	**Power (Watts)**	**Heat Output (BTUs)**
18 ports per sLB-4018	9 sFB-4700, 1 sLB-4018, 1 sFU-40H, 1 sFU-40V, 1 sMB, 2 sPSU-S	2,041W	6,965
108 ports (6 sLBs x 18 port per sLB)	9 sFB-4700, 6 sLB-4018, 1 sFU-40H, 1 sFU-40V, 1 sMB, 2 sPSU-S	2,674W	9,123

Configuration	Modules Included	Power (Watts)	Heat Output (BTUs)
324 ports QSFP copper	9 sFB-4700, 18 sLB-4018, 1 sFU-40H, 1 sFU-40V, 2 sMB, 3 sPSU-S	4,244W	14,479
324 ports QSFP copper + HyperScale Fabric Boards	9 sFB-4700x2, 18 sLB-4018, 1 sFU-40H, 1 sFU-40V, 2 sMB, 4 sPSU-S	5,279W	18,010

3.11 Maximum Heat Dissipation

Table 12: Maximum Heat Dissipation

Maximum heat dissipation	(max. for full configuration)	22,206 BTU/Hour

3.12 Airflow

Table 13: 4700 Airflow

Rated volumetric air flow for a fully configured chassis.	1300 CFM (Cubic Feet per Minute)

3.13 Physical Characteristics

Table 14: 4700 Physical Characteristics

4700 Features	Characteristics
19" rack mountable chassis	19U height
Dimensions	Width - 19" (440 mm) Depth - 22.75" (578 mm) Height - 25.6" (650 mm)
Weight	128 to 163 lbs (58 to 74 kg), depending on configuration
Minimum rack depth required for the rail kit	N/A
Maximum rack depth required for the rail kit	N/A

Table 15: HyperScale Physical Characteristics

HyperScale Features	Characteristics
HyperScale rack mountable chassis	20U height

3.14 Weights and Dimensions

Table 16: Weights and Dimensions

	Metric (2)				English (1)			
Unpacked Modules	D (cm)	W (cm)	H (cm)	Kg	D (in)	W (in)	H (in)	Lbs
Packed Modules	D	W	H	Kg				
sMB-CM	33	22	4.5	1.1	13	8.7	1.77	2.42
	40	28	7.5	1.4	15.7	11	3	3

	Metric (2)				English (1)			
sPSU-S	36	13	4.5	1.85	14	5	1.8	4
	42	21	12	2.6	16.5	8.2	4.7	5.7
sFU-40H	33	43	12	3.9	13	17	4.7	8.6
	44	52	19	4.5	17.3	40.4	7.4	9.9
Chassis	68	44	84	81	26.77	17.32	33	178.57
	88	57	119	110	34.6	22.4	46.85	242.5
sFU-40V	38	67	14	4.8	15	26.3	5.5	10.6
	46	73	22.5	6.2	18	28.7	8.85	17.7
sFB-4700	66	32	4	3.2	30	12.6	1.57	7
	78	40	7	3.9	28.7	16	3.54	8.6
sFB-4700x2	66	32	4	4.5	30	12.6	1.57	11.2
	78	40	7	5.4	30.7	15.75	2.75	11.9
sLB-4018	43	33	4	2.9	17	13	1.57	6.4
	51.5	40	9.5	3.5	20.2	15.7	3.74	7.7
Blank sFB	66	32	4	1.9	30	12.6	1.57	4.2
	78	40	7	2.6	30.7	15.75	2.75	5.7
Blank sLB	43	3	4	0.26	17	1.18	1.57	0.57
	63	8	3.5	0.36	24.8	3.14	1.38	0.8
Blank sMB	4	22	4	0.12	1.57	8.66	1.57	0.26
	63	8	3.5	0.22	24.8	3.14	1.38	0.48
Blank PS	4	15	5	0.09	1.57	6	2	0.12
	63	8	3.5	0.19	24.8	3.14	1.38	0.42
Rail Kit	53.2	14.5	4.3	9	21	5.7	1.7	19.84
	62	14	7.5	8	24.5	5.5	2.95	17.63
Cable Mgmnt	64	13	4	2.8	25	5	1.57	6.17
	75	23	15	3.7	29.5	9	6	8.15
Rack Mount Kit for 4700 with HyperScale Fabric Boards	-	-	-	-	-	-	-	-
	41.5	75	12.5	12.2	16.34	29.5	4.92	27.12

(1) 1 in = 2.54 cm (2) 1 kg = 2.205 lbs

3.15 LED Indicators

This section specifies the LED indicators of the different Grid Director 4700 modules.

3.15.1 sLB-4018 Line Board LEDs

Table 17: sLB-4018 Line Board LEDs

Indication	LED Description	Remarks
Link State 18 Amber LEDs 18 Green LEDs HW only	The two LEDs in each pair are as follows: • Green – ON indicates physical link up • Amber – ON indicates logical link up The LED states are as follows: • OFF – no link detected • ON – the port has a link • Blinking: Green – indicates errors Amber – indicates data activity	Indicates the state of the QSFP connectivity.
Power (Green) HW only	ON – indicates that all board voltage levels are operating normally OFF – indicates a problem in power supply to the board	
Info (Blue) User only	General purpose LED for management use OFF – No attention required Blinking – Chassis attention required	
Card Ready (Green)	OFF – Card not Ready ON – Card ready Blinking Slowly – Card loading Blinking Fast – Card problem	

3.15.2 Fabric Board (sFB-4700) LEDs

Table 18: Fabric Board (sFB-4700) LEDs

Indication	LED Description	Remarks
Link 18 Amber LEDs 18 Green LEDs HW only	Each pair of LEDs indicates the state of ports of each Line Board. The two LEDs in each pair are as follows: • Green – ON indicates physical link up • Amber – ON indicates logical link up The LED states are as follows: • OFF – no link detected • ON – link detected • Blinking: Green – indicates errors Amber – indicates data	18 pairs of internal link indication LEDs. Each pair of LEDs indicates the state of two ports of each Line Board.
Power (Green) HW only	ON – indicates that all board voltage levels are operating normally OFF – indicates a problem in power supply to the board	
Info (Blue)	General purpose LED for management use	

Indication	LED Description	Remarks
User only	OFF – No attention required Blinking – Chassis attention required	
Card Ready (Green)	OFF – Card not Ready ON – Card ready Blinking Slowly – Card loading Blinking Fast – Card problem	

3.15.3 HyperScale Fabric Board (sFB-4700-2X) LEDs

Table 19: HyperScale Fabric Board (sFB-4700-2X) LEDs

Indication	LED Description	Remarks
Link 18 Green LEDs HW only	Each LED indicates the state of ports of each Line Board. • ON – indicates physical link up • OFF – no link detected • Blinking – indicates errors	18 pairs of internal link indication LEDs. Each LED indicates the state of two ports of each Line Board.
CXP Link 36 Amber LEDs 36 Green LEDs HW only	The two LEDs in each pair are as follows: • Green – ON indicates physical link up • Amber – ON indicates logical link up The LED states are as follows: • OFF – no link detected • ON – the port has a link • Blinking: Green – indicates errors Amber – indicates data activity	Indicates the state of the 36 external QSFP port connectivity.
Power (Green) HW only	ON – indicates that all board voltage levels are operating normally OFF – indicates a problem in power supply to the board	
Info (Blue) User only	General purpose LED for management use OFF – No attention required Blinking – Chassis attention required	
Card Ready (Green)	OFF – Card not Ready ON – Card ready Blinking Slowly – Card loading Blinking Fast –Card problem	

3.15.4 Management Board (sMB-CM) LEDs

Table 20: Management Board (sMB-CM) LEDs

Indication	LED Description	Remarks
Fans (Green)	OFF – All fan drawers are OK.	Two fan drawers

Indication	LED Description	Remarks
	ON – Vertical and Horizontal fan unit fault indication. Indicates that at least one of the 13 fans has failed.	
Temp (Orange)	OFF – Indicates normal temperature levels. ON – Indicates an over-temperature fault on the chassis.	Temp (Orange)
FM Active (Green)	OFF - Fabric Manager is not active ON - Fabric Manager running on the Management Board Blink - Fabric Manager is standby on the Management Board	
DM Active (Green)	OFF - Device Manager is not active ON - Device Manager running on the Management Board	
Power (Green) HW Only	OFF – indicates a problem in power supply to the board ON – indicates that all board voltage levels are operating normally	
Info (Blue) User only	General purpose LED for management use OFF – No attention required Blinking – Chassis attention required	
PSU OK (Green)	OFF – N/A ON – System Power OK Blinking – System Power problem	AC-DC power supply fault indication. Indicates that at least one of the main AC-DC power supplies has an AC or DC fault
Eth—1 and 2	Two LEDs: Link (Green) and Activity (Orange)	Eth—1 and 2

3.15.5 sFU-40H Horizontal Fan Unit LEDs

Table 21: sFU-40H Horizontal Fan Unit LEDs

Indication	LED Description	Remarks
Temp (Orange)	ON – Indicates an over-temperature fault on the chassis. OFF – Indicates normal temperature levels.	
sFU-40V (Orange)	ON – Vertical fan unit fault indication. Indicates that at least one of the five fans in the vertical fan unit has failed. OFF – All fans in the vertical fan unit are OK.	
sFU-40H (Orange)	ON – Horizontal fan unit fault indication. Indicates that at least one of the eight fans in the horizontal fan unit has failed. OFF – All fans in the horizontal fan unit are OK.	
PS (Orange)	AC-DC power supply fault indication. ON – Indicates that at least one of the main AC-DC power supplies has an AC or DC fault. OFF – All PSUs are OK.	

3.15.6 sPSU-S Power Supply LEDs

Table 22: sPSU-S Power Supply LEDs

Indication	Description
DC ON (Green)	ON – Indicates that the DC power source is present.
AC ON (Green)	ON – Indicates that the AC power source is present.

3.16 Environmental Specifications

Table 23: 4700 Environmental Specifications

Ambient Operating Temperature	32° to 113°F (0° to 45°C)
Operating Humidity	15 to 80%, non-condensing
Operating Altitude	0 to 9843 ft (3000m)
Storage Temperature	-13° to 158°F (-25° to +70°C)
Storage Humidity	5 to 90% non-condensing
Storage Altitude	0 to 15,000 ft (4570m)

3.17 Acoustic Data

Acoustic noise is reported in accordance with ISO 7779 [ECMA 74] standard.

3.18 Reliability (MTBF)

The Mean Time between Failures (MTBF) for individual switch components is shown in the following tables. These figures indicate the mean elapsed time until a single component fails in the module, whether or not that failure impacts the operation of the switch. Note that in many cases redundant modules can be configured, which dramatically increases the overall system Mean Time between Critical Failures (MTBCF).

MTBF per 4700 model types:

- Model A: The system configuration is a fully populated chassis with 18 line cards, 9 fabric cards, 3 power supplies, 1 Management Board and 2 fan modules (Horizontal and Vertical drawers).
- Model B: The system configuration is a fully populated chassis with 18 line cards, 9 double fabric cards, 4 power supplies, 1 Management Board and 2 fan modules (Horizontal and Vertical drawers).

Table 24: Reliability (MTBF) Specifications

4700 QDR Director	FPMH	MTBF (Hours)
Model A	66.308	15,081
Model B	75.431	13,257

Table 25: MTBF per Module Data

Chassis/Module	Description	MTBF (Hours)
sFB-4700	9 QDR port connections fabric board	519, 426
sFB-4700-2X	9 QDR port connections x2 fabric board	345,941
sLB-4018	sLB-4018, 18 QSFP ports per sLB-4018	419,866
sMB-CM Management Board	Management board	441,273
sFU-40H Horizontal Fan Unit FRU	Horizontal fan unit	708,754
sFU-40V Vertical Fan Unit FRU	Vertical fan unit	913,145
sPSU-S	Power supply	2,303,086

3.19 Certifications

- cMETus UL 60950-1:07 Second Ed.
- CSA C22.2 No. 60950-1-07 Second Ed
- cTUVus UL60950-1: 07 Second Ed.
- S-Mark Argentina
- CB Certificate and report, according to IEC 60950-1 Second Ed.
- KCC Korea
- Gost-R
- CE according to EN 60950-1:06 Second Ed
- S-Mark

EMC Certifications

- FCC Part 15, Subpart B, Class A and testing to ANSI 63.4
- Industry Canada ICES-003 (CAN/CSA-CEI/IEC CISPR 22:02)
- CE EN55022: 1998 + A1:2000 + A2:2003
  EN55024: 1998 + A1:2001 + A2:2003
  - EN 61000-3-2:00+A2(05) Harmonic current emissions
  - EN 61000-4-2: 1995 + A1: 98 + A2: 2001
  - EN 61000-4-3: 02 + A1: 2002
  - EN 61000-4-4: 1995 + A1: 01 +A2:2001
  - EN 61000-4-5: 1995 + A1: 2001
  - EN 61000-4-6: 1996 + A1: 2001
  - EN 61000-4-8: 1993 + A1:2000
  - EN 61000-4-11: 1994 + A1: 2001

  - EN 61000-3-3:95+A1 (01) Voltage fluctuations and flicker
- Japan VCCI Technical Requirements, V.3/2001.04/CISPR 22:1997 + A1: 2000 + A2: 2002, Class A.
- Australian/New Zealand C-Tick, AS/NZS CISPR 22:04
- KCC Korea

Restricted Hazardous Substances Certification

RoHS-6

InfiniBand Certification

IBTA 1.2

3.20 Declarations

3.20.1 Declaration of Conformity

Mellanox products comply with the Radio & Telecommunications Terminal Equipment Directive 99/5/EEC, the EMC Directive 2004/108/EC, and of the Low Voltage Directive 2006/95/EC.

3.20.2 Hazardous Substances (RoHS 6) Compliance Declaration

Mellanox products comply with the RoHS directive.

3.21 Label(s)

The Grid Director 4700 label (example) below shows safety and EMC text and logos.

Figure 11: 4700 Label (example)

3.22 Gost-R Certification

Mellanox products comply with the Gost-R Russian safety regulations.

3.23 KCC-Korea Certification

Mellanox products comply with the Korean KCC regulations.

3.24 Oscillator Speeds

Oscillator speeds are shown in the following table.

Table 26: Oscillator Speeds

Mellanox PN	Description	Frequency	Card
141C00005	CRYSTAL PECL156.25MHZ, JOE75-SMD, H=1.4MM	156.25 MHz	sFB-4700, sFB-4700-2X, sLB-4018
OSC-00005	OSCILLATOR PECL 100MHZ 7 X 5 X 1.9MM +50PPM	100MHz	sFB-4700, sFB-4700-2X, sLB-4018, sMB-CM
141C71200	OSCILLATOR 125MHZ 5.0 X 7.0 X 2.0 MM	125MHz	sFB-4700, sFB-4700-2X, sLB-4018, sMB-CM

Mellanox PN	Description	Frequency	Card
OSC-00009	OSCILLATOR, 2.5V HCMOS/TTL 66.66MHZ 50 PPM	66.66MHz	sFB-4700, sFB-4700-2X, sLB-4018, sMB-CM
141C65000	OSCILLATOR 50MHZ 7.5 X 5.0 X 1.4 MM 3.3V +50PPM	50MHz	sFB-4700, sFB-4700-2X, sLB-4018
OSC-00008	OSCILLATOR 3.3V CMOS 48MHZ 50 PPM	48MHz	sMB-CM
OSC-00007	OSCILLATOR HCMOS/TTL 25MHZ	25MHz	sMB-CM
OSC-00011	OSCILLATOR HCMOS/TTL 25MHZ 2.5V	25MHz	sFB-4700, sFB-4700-2X, sLB-4018
OSC-00010	OSC. HCMOS/TTL 25MHZ 1.8V 50PPM TR=4NS MAX 7X5MM	25MHz	sMB-CM
OSC-00006	OSCILLATOR SE 1.8V 19.2MHZ +-50PPM	19.2MHz	sMB-CM

3.25 Shock and Vibration Test Reports

Prepare the Grid Director 4700 to ship in a rack by carefully following the rail kit installation instructions, as detailed in Assembling and Mounting the Rails. The Grid Director 4700 is susceptible to shock and vibration if the rail kit installation instructions are not followed precisely.

The following tables detail the shock and vibration test reports, compliant with shipping in a rack.

3.25.1 4700 Test for Transportation without a Rack

Table 27: Vibration

Test	Description	
Vibration Axes	3 axes (X,Y,Z)	
Non-Operating Random Vibration	Frequency range:	5–300Hz
	Vibration level:	Z axis, 1.03g RMS X,Y axis 0.698g RMS
	Vibration test for each axis	60 minutes
Operating Sine Vibration	Frequency range:	5-500Hz
	Vibration level:	0.1G peak
	Vibration test for each axis	40 minutes
Operating Shock (half-sine)	Vibration Level	Z axis, 5g peak
	Shock test for Z axis	3 shocks, 10ms duration each shock

Table 28: Free Fall

Test	Description
Drop Height	0.1 meter
Number of drops of test item	One drop performed on the bottom face, 2 edges and 2 corners of the test item
Total number of drops	5 drops

3.26 Export Information

Composite Theoretical Performance (CTP) is a calculation measured in MTOPS (millions of theoretical operations per second).

The 460EX/460GT contain a 440H6 core (not a 460 core; it is called 460 to distinguish it as a 90 nm core).

The CTP (in MTOPS) for the PPC440 core = (17/18) * F (where F is the CPU clock rate in MHz).

Refer to the following table accordingly:

Table 29: Export Information

CTP value for the PPC440 core 460EX/460GT @ 600MHz	~ 567 MTOPS
CTP value for the PPC440 core 460EX/460GT @ 1000MHz	~ 944 MTOPS
ECCN	5A991C

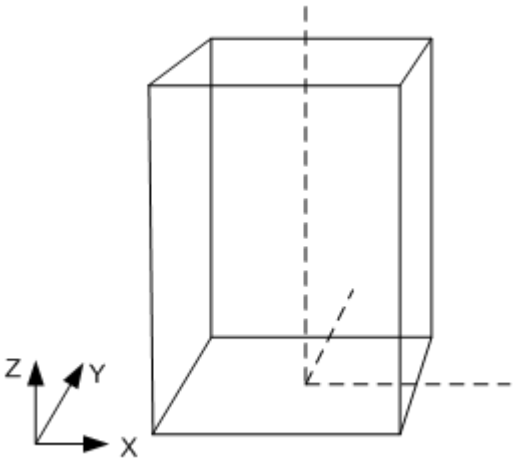
3.27 Shipping Restrictions

None.

3.28 Center of Gravity Data

This section provides the Grid Director 4700 center of gravity specifications. The measurement origin starts at the front lower left corner of the chassis.

Figure 12: Center of Gravity Data



Center of gravity for minimum, typical, and maximum configurations are shown in the following table.

Table 30: Center of Gravity Data

4700	Width (X) - mm	Depth (Y) - mm	Height (Z) - mm
Empty Chassis	220	250	345
Basic Configuration	220	270	330
Full Configuration	220	300	320

3.29 Statement of Volatility

Refer to the Grid Director 4700 Statement Of Volatility document.

4 Packing and Unpacking

This chapter provides step-by-step instructions for packing and unpacking the Grid Director 4700 chassis.

4.1 Package Contents

The Grid Director 4700 is supplied in a heavy duty tri-wall cardboard box secured with packing straps.

For information about the various 4700 configurations and items shipped with the chassis, refer to Chapter 1 (on page 18).

The basic 4700 shipping contents are as follows:

- Grid Director 4700
- Horizontal fan unit (sFU-40H)
- Vertical fan unit (sFU-40V)
- Management board (sMB-CM)
- Two power supply units (sPSU-S).

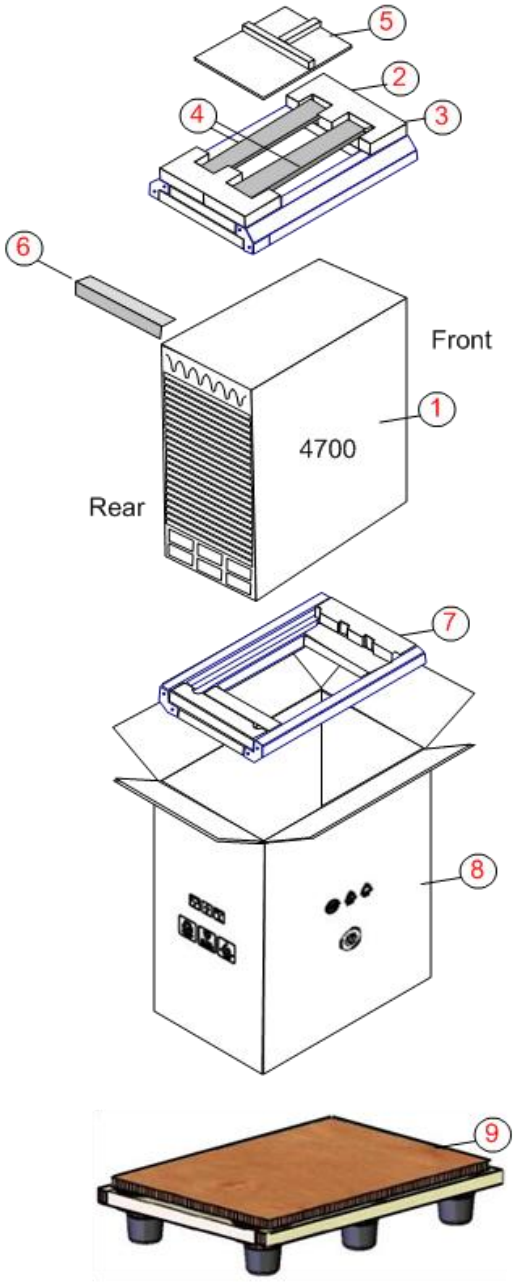
The Grid Director 4700 chassis is shipped with a horizontal fan unit (sFU-40H) and a vertical fan unit (sFU-40V) installed at the front of the chassis and two power supplies at the rear of the chassis.

Additional components include:

- Rail kit for rack installation
- Cabling guide brackets
- One power cord per power supply
- One console cable
- A grounding kit
- Mellanox Getting Started Short Guide
- Two product CDs (one containing the software, one containing the documentation).

Verify that the package contains the items detailed in the packing list before you begin to install the Grid Director 4700.

Check for loose parts or any visible damage to the contents. If any damaged or missing parts are detected, notify your local Mellanox representative.



Part Number	Description
1	Grid Director 4700
2	Top Foam
3	Cable Management
4	Mounting Rails (Left and Right)
5	Foam Plate
6	Carton Plate – placed at the top of the rear of the chassis to protect the opening
7	Bottom Foam

Part Number	Description
8	Cardboard Box
9	Pallet

4.2 Unpacking the Grid Director 4700

➢ ***To unpack the Grid Director 4700 chassis:***

1. Carefully cut the packing straps and open the carton box.
2. Remove the box from around the chassis by sliding it upwards, as shown.

The Grid Director 4700 chassis in its partially unpacked state is shown as follows.

The upper packing foam covering the Grid Director 4700 contains the following components:

- Rail kit
- Cabling guide brackets (cable management)

- Screw kit
- Grounding kit
- Console cable
- Power cables
- Getting Started Short Guide – Mellanox Solution
- CD with documentation and software utilities fastened on top of the Grid Director 4700 chassis wrapped in an antistatic bag.

3. Remove all of the accessories listed above and as well as the packing foam on top of the chassis.
4. Lift the Grid Director 4700 from the pallet and place it on a flat surface. Due to the weight of the Grid Director 4700 chassis, two people are required to perform this.

Use the four handles at top of chassis to carry or move the unit.

Use safe lifting procedures when moving the unit to avoid personal injury.

4.3 Packing the Grid Director 4700 Switch

If you need to move the Grid Director 4700 switch to a different physical location, pack the equipment according to the following procedure.

➢ ***To pack the Grid Director 4700 chassis:***

1. Insert the foam grip on the pallet.
2. Position the chassis on the foam. Verify that the two sFU-40H horizontal fan unit handles at front of chassis point to the two niches in the bottom foam.
3. Place the foam plate then the top foam on top of the chassis. The foam protection padding fits snugly over the chassis top.
4. Insert the accessories in the top foam dedicated locations.
5. Slide the cardboard box over the chassis and foam with the flaps facing up. Make sure it sits well on the pallet indent
6. Fasten the box and secure it with the pallet using packing straps.

The packing list and part numbers (bar codes) are glued to the box. Safety labels are printed on the box.

Figure 13: 4700 Switch Packed

5 Preparing for Installation

This chapter describes how to prepare your site.

Read this chapter before you install the switch.

5.1 Tools Required for Installation

The following tools and materials are required for mounting the Grid Director 4700 chassis.

Table 31: Required Tools and Materials

Quantity	Description
1	Phillips screwdriver
1	Utility knife
1	Measuring tape
1	Crimping tool
1	Wire stripping tool
1	Digital Voltmeter (DVM)
	Floating nuts
	Phillips screws

5.2 Site Planning

It is essential that you plan the proper location and layout of your equipment rack. Equipment placed too close together or in an inadequately ventilated area can cause an increase in temperature and inadequate cooling conditions. In addition, be sure to place the system panels so that they are accessible and easy to reach system panels inaccessible and difficult to maintain.

Plan your site configuration and prepare your site before installation to ensure normal operation and avoid unnecessary maintenance.

Refer to Environmental Specifications for the operational and non-operational environmental site requirements for the Grid Director 4700. The system can continue to operate within specified environmental ranges; however, a measurement that approaches the minimum or maximum of a range indicates a potential problem.

You can maintain normal operation by anticipating and correcting environmental conditions before they exceed the maximum operating range. Verify the site power for the type of device you are installing. Power requirements are useful for planning the power distribution system needed to support the Grid Director 4700. Heat dissipation is an important consideration for sizing the air-conditioning requirements for an installation.

Refer to Power Data and Calculating Heat Output in BTUs for 4700 power and heat ratings.

To prevent a loss of input power, verify that the total maximum load on the circuit supplying power to the power supply is within the current ratings of the wiring and breakers.

5.3 Rack Requirements

The 19U-high 4700 chassis is mounted in a standard 19" rack with the fabric boards facing the front of rack and the Line Board InfiniBand ports and sMB-CM facing the rear of the rack.

The rack should support the mechanical and environmental characteristics of a fully populated 4700 chassis as listed in Environmental Specifications.

The rack mounting holes conform to the IEA-310 standard for 19-inch racks. Precautions should also be taken to guarantee proper ventilation and ambient temperature is maintained for air intake at the front of the chassis and exhaust in the rack.

The HyperScale cable guide requires an additional 1U of rack space, making the total height 20U instead of 19U.

5.4 Clearance Requirements

You should be certain to provide sufficient clearance around the racks to install and maintain the Grid Director 4700. Clearance specifications are detailed in Chapter 3 (on page 27).

5.5 Site Environment Specifications

The system can continue to operate within specified environmental ranges; however, a measurement that approaches the minimum or maximum of a range indicates a potential problem. You can maintain normal operation by anticipating and correcting environmental conditions before they exceed the maximum operating range.

Refer to Environmental Specifications (on page 35) for operating and non-operating environmental site requirements.

5.6 Chassis Grounding

Grounding connection is performed at the customer's site. Connect the chassis to a reliable earth ground. Ensure that the host is connected to earth ground during normal use.

- The ground wire should always be hooked up first and disconnected last.
- Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.

The Grid Director 4700 is delivered with a grounding stud kit. The system must be permanently grounded using the grounding stud.

The grounding kit includes the following items:

- A 10-32 5/8" screw
- 3 spring washers
- 2 nuts #10
- Ground label
- Safety warning label.

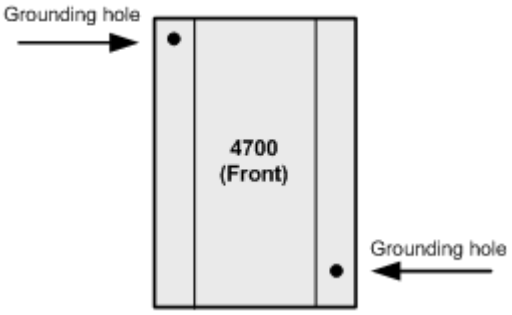
This grounding procedure requires a 6 AWG Grounding Cable.

Figure 14: 4700 Grounding Connection

Figure 15: Ground Warning Label

The Grid Director 4700 provides two grounding options, as shown. For convenience, grounding can be performed from any of these locations.

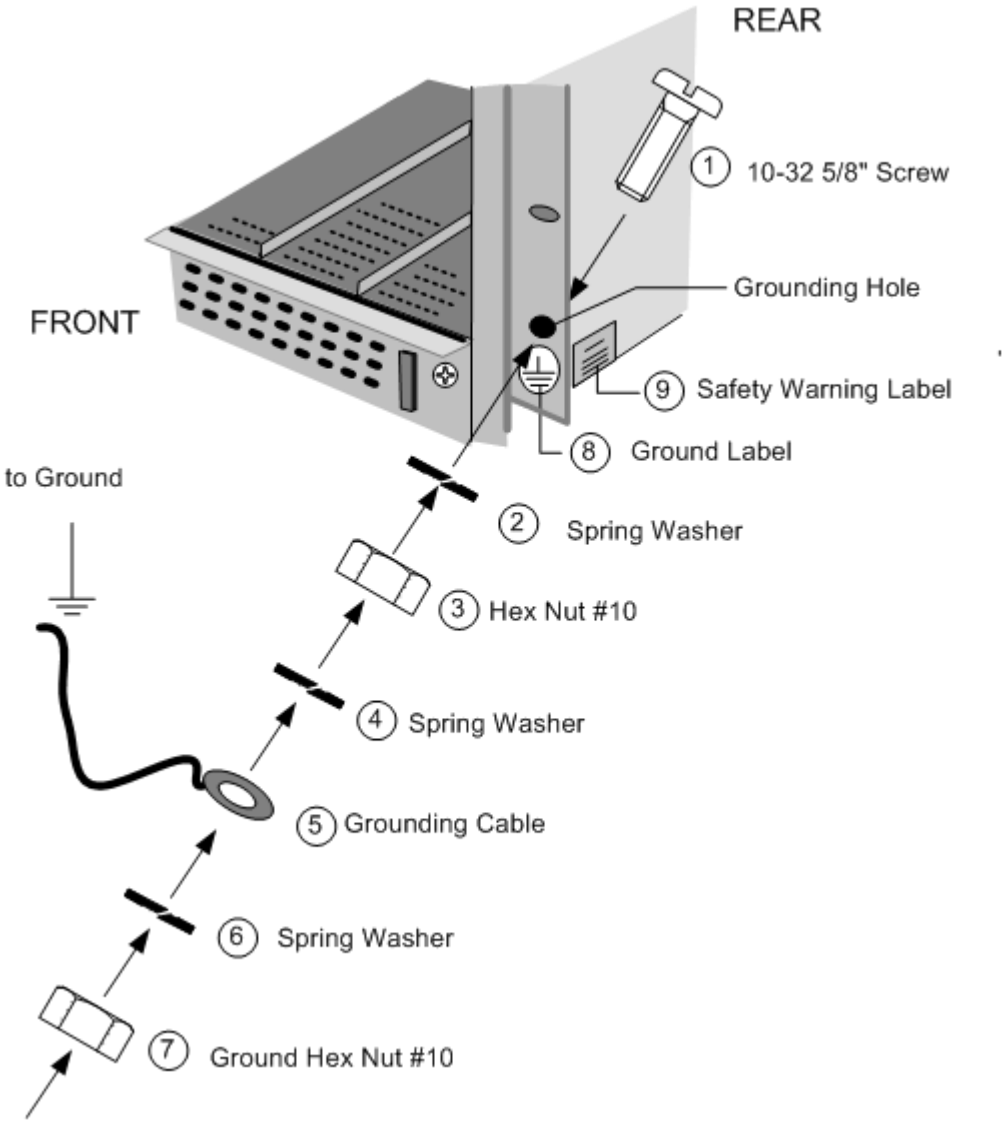
Figure 16: Grounding Holes for 4700



Install the grounding stud before you mount the Grid Director 4700 chassis onto the rack.

➢ ***To install the Grounding Stud:***

1. Insert a 10-32 5/8" screw through the Grounding hole, rear-to-front, as shown.



2. Add a spring washer onto the 10-32 5/8" thread, this time front-to rear.
3. Add a nut #10.
4. Add another spring washer.
5. Insert the 6 AWG grounding cable. Connect the other end of the grounding cable to a grounding point at your site.
6. Add another spring washer. Make sure that the grounding cable is tightly secured between the two spring washers.
7. Secure everything with a grounding nut #10.
8. Apply the Ground label under the grounding nut.
9. Apply the Safety Warning label on the side of the chassis, near the grounding stud.

5.7 Power Requirements

Power requirements are useful for planning the power distribution system needed to support the Grid Director 4700. Heat dissipation is an important consideration for sizing the air-conditioning requirements for an installation. Verify the available power source at the site for the type of device you are installing.

Refer to Power Data (on page 27) for power specifications and heat ratings.

To prevent a loss of input power, verify that the total maximum load on the circuit supplying power to the power supply is within the current ratings of the wiring and breakers.

The Grid Director 4700 requires multiple power connections using standard 3-wire AC power cords including a safety ground. The input voltage is auto adjusting for 100/240 VAC, 50Hz or 60Hz power connection. If you do not use the power cords supplied by Mellanox, the power cords should be rated for 15A or higher.

The Grid Director 4700 includes hot-swappable power supply units (sPSU-S) with N:1 or N:N redundancy. A non-redundant power configuration includes the minimum number of power supplies required by the system for operation.

N:N redundancy implies that each non-redundant power supply is fully backed up by a redundant power supply, which is routed to a different power source. This provides for full power backup in case the first power source is disconnected.

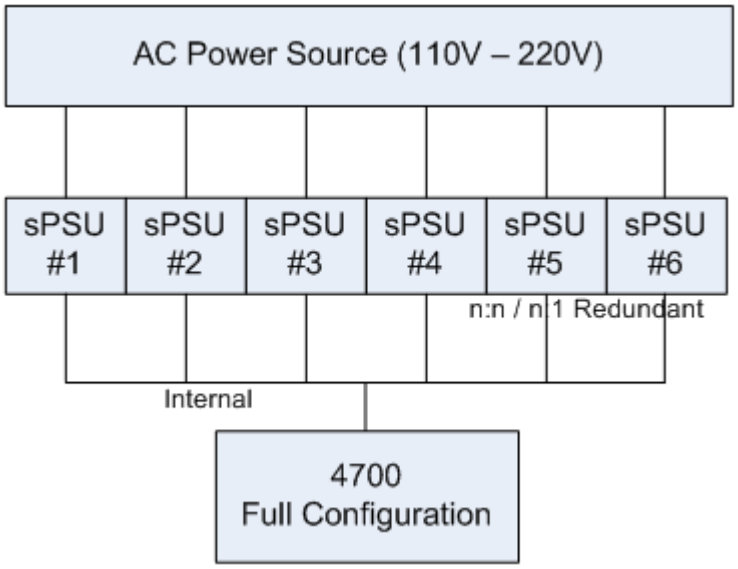
N:1 implies that all the system non redundant power supplies are connected to a single power source and are backed up by one spare power supply.

N:M is for spare power supplies. N stands for required units, while M stands for spares. This covers 2:1, as well as 3:2 redundancies.

The Grid Director 4700 supports up to six load sharing 1400W power supplies with separate AC power connections. Each power supply must be powered from separate sockets with circuit breaker 16A for Europe or 20A for North America.

The amount of required power supplies per system is set according to system configuration. When the Grid Director 4700 is fully configured, it supports N:1 redundancy, as shown in the example below.

Figure 17: 4700 Fully Configured - N:1 Redundancy



The following table describes the Grid Director 4700 N:1, N:N, and N:M redundancies.

Table 32: 4700 QDR N:1/N:N Redundancy

Configuration	Modules Included	Non-redundant power supplies	N:1	N:N or N:M
18 ports QSFP copper	9 sFB-4700 1 sLB-4018 1 sFU-40H 1 sFU-40V 1 sMB-CM 2 sPSU-S	2	3 (2:1)	4 (2:2)
162 ports QSFP copper	9 sFB-4700 9 sLB-4018 1 sFU-40H 1 sFU-40V 1 sMB-CM 2 sPSU-S	2	3 (2:1)	4 (2:2)
324 ports QSFP copper	9 sFB-4700 18 sLB-4018 1 sFU-40H 1 sFU-40V 2 sMB-CM 3 sPSU-S	3	4 (3:1)	6 (3:3)

6 Rack-Mounting the 4700 Chassis

6.1 Mounting Process Summary

The 4700 chassis is mounted in a standard 19" rack with the Fabric Boards facing the front of the rack. The 4700 is provided with an adjustable rail kit to accommodate racks of differing depth. The 4700 rail kit is adjustable to accommodate a distance of depths of 24" (60 cm) to 40" (100 cm) between the rack's EIA rails.

In addition, the chassis is delivered with cable management (cabling guide brackets).

> The HyperScale cable guide requires an additional 1U of rack space, making the total height 20U instead of 19U.

The mounting process consists of the following stages:

1. Standard chassis installation (up to 324 port configuration)
   - Assembling and mounting the rail.
   - Mounting the chassis on the rail, in a rack.
   - Installing the cable management.
2. HyperScale chassis installation (up to 648 port configuration)
   - Assembling and mounting the rail.
   - Remove the standard 19" brackets (keep the screws for installation of the 19" brackets).
   - Install the 19" long brackets (part of P/N KIT-000222).
   - Slide and mount the chassis into the rack.
   - Installing the cable management.
   - Install the HyperScale cabling guide bracket. Note that you should count 5 slots to the left of the bracket prior to installing it.

Refer to Chapter 9 (on page 77) for more information.

> Because of the 4700 chassis weight, at least two people are required to mount this unit in a rack.

6.2 Assembling and Mounting the Rails

This section describes how to assemble and mount the rails:

- Rail kit and mounting components
- Overview of the assembling and mounting procedure
- Assembling and mounting procedure in detail, the steps accompanied by figures, showing the components as they appear aligned and then assembled one by one.

6.2.1 Rail Kit and Mounting Components

The 4700 package includes:

- Rail kit
- Mounting ears (or 19" brackets) that are factory installed at the front of the chassis

The supplied rail kit is adjustable to allow for mounting the chassis in racks of varying depths. The rail bracket kit includes the following items:

- Left bracket (left rail)
- Right bracket (right rail)
- 2 inserts (with elongated holes) – same for both left and right rails
- 8-32 screws 5/8" (qty: 2 x 8)
- 8-32 screws 3/8" (qty: 2 x 3) – to be used in case of chassis transportation in a rack.
- 8-32 nuts (qty: 2 x 11)
- M4 flat washers (qty: 2 x 11)
- Spring washers (qty: 2 x 8)
- Tooth washers (qty: 2 x 3)

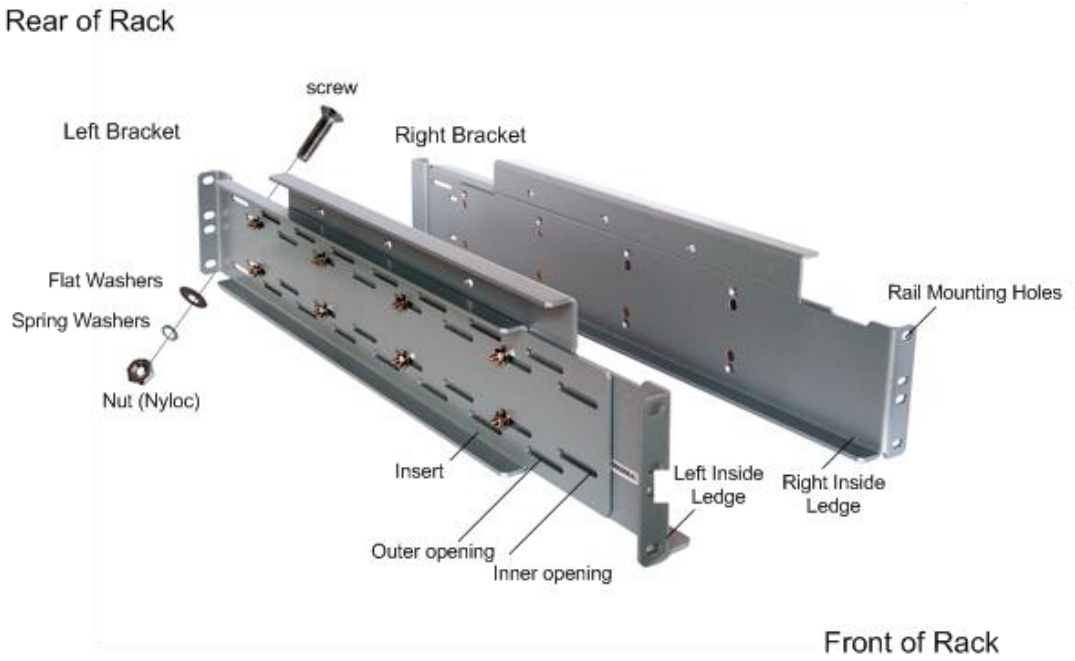
Clip nuts are not provided.

6.2.2 Rail Kit Assembly Overview

This section shows a diagram of an assembled rail kit and provides the procedures for assembling the rail kit.

The following image shows the two rails completely assembled and displays the left rack assembled to the rack, and how the left rail looks when it is attached to the rack.

Figure 18: Overview of Assembled Rail Kit



- Use all 8 screws. Note the order of the nuts and washers.
- Select the inner openings or outer openings (as shown), depending on the rack vertical rails locations. Inside ledges are used for sliding the chassis along the rail.

Procedure Summary

Perform each step of the following procedure for both rails.

1. Use 8-32 5/8" screws and flat washers and spring provided with the kit to assemble the rail, positioning the insert in front of the bracket.
2. For each of left and right rails, take a bracket and attach an insert (the two inserts are identical). At this stage, position the two parts to fit the distance between the rack rails of each side.
   - Make sure that you are using the right bracket for the right rail (right side when facing the front of the rack) and the left bracket for the left rail (left side when facing the front of the rack). The insert is identical for both rails.
   - The rail supports six or eight 8-32 5/8" screws. Eight is recommended.
3. Select the counter sunk holes in the bracket.
4. Assemble the rail with flat washers, spring washers, and nuts.

   IMPORTANT: Do not tighten the screws at this time.
5. Align the rail mounting holes with the mounting holes in the equipment rack.
6. Install the rail kit by positioning the rail brackets in alignment with the adequate mark on the rack.

7. Attach the front side of the rail to the rack's front vertical side rail with 2 screws for each side and the rear side of the rail to the rack's rear vertical side rail with 2 screws for each side.

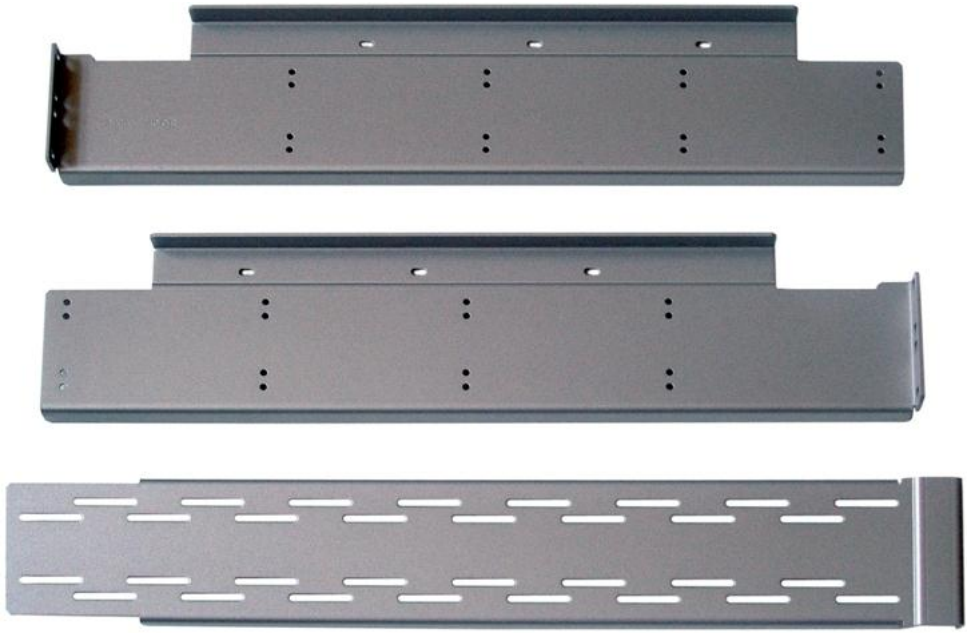
   IMPORTANT: If you do not tighten the screws, the chassis cannot be mounted safely in the rack.

8. Repeat steps 1 to 3 to assemble the other rail and mount it on the other side of the chassis; the rails are now ready for chassis installation.

   IMPORTANT: When mounting the rail ensure box-to-box vertical alignment on all four rack rails. See that the bottom side of the rail is aligned with the 1U marking on the rack rail.

6.2.3 Rail Kit Assembly Procedure

This section presents the procedure for assembling and mounting the rail kit. Each step is accompanied by a figure, showing the components as they appear aligned and then assembled one by one.



In addition, eight screw sets are included, comprising one screw, one nut, and two washers.

➢ ***To assemble the rail:***

1. Use 8-32 5/8" screws and flat washers and spring provided with the kit to assemble the rail, positioning the insert in front of the bracket as shown below.

   1. For each of left and right, take a bracket and attach an insert (the two inserts are identical). At this stage, position the two parts to fit the distance between the rack rails of each side.

      - Make sure that you are using the right bracket for the right rail (right side when facing the front of the rack) and the left bracket for the left rail (left side when facing the front of the rack). The insert is identical for both rails.

- The rail supports six or eight 8-32 5/8" screws. Eight is recommended.

Figure 19: Positioning the Insert in Front of the Right Bracket

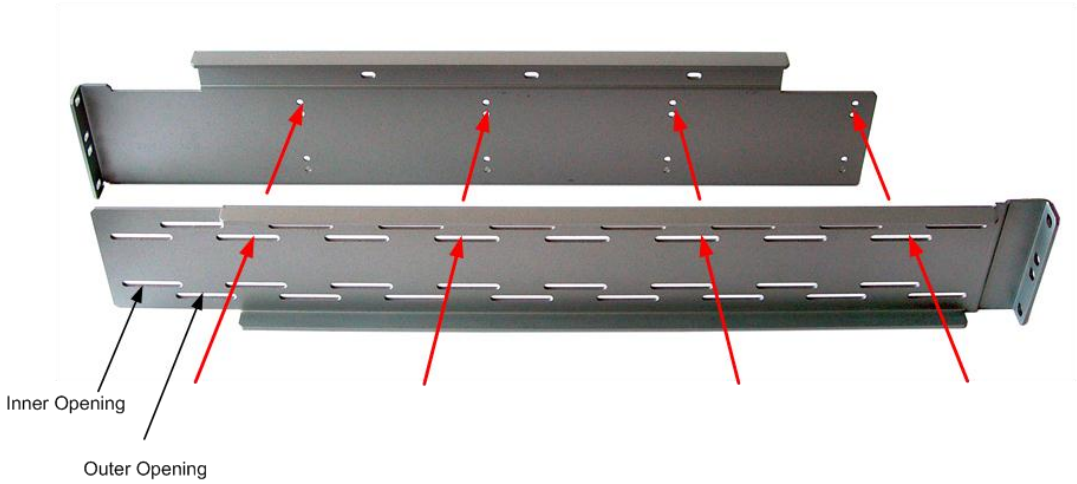
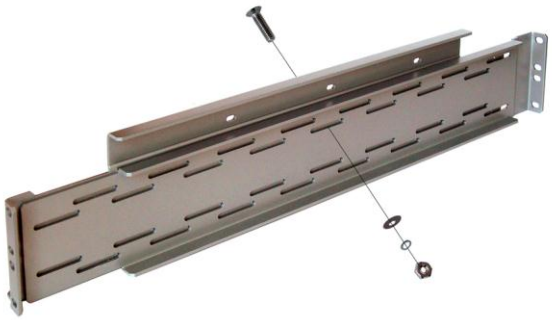


Figure 20: Assembling the Rail Bracket



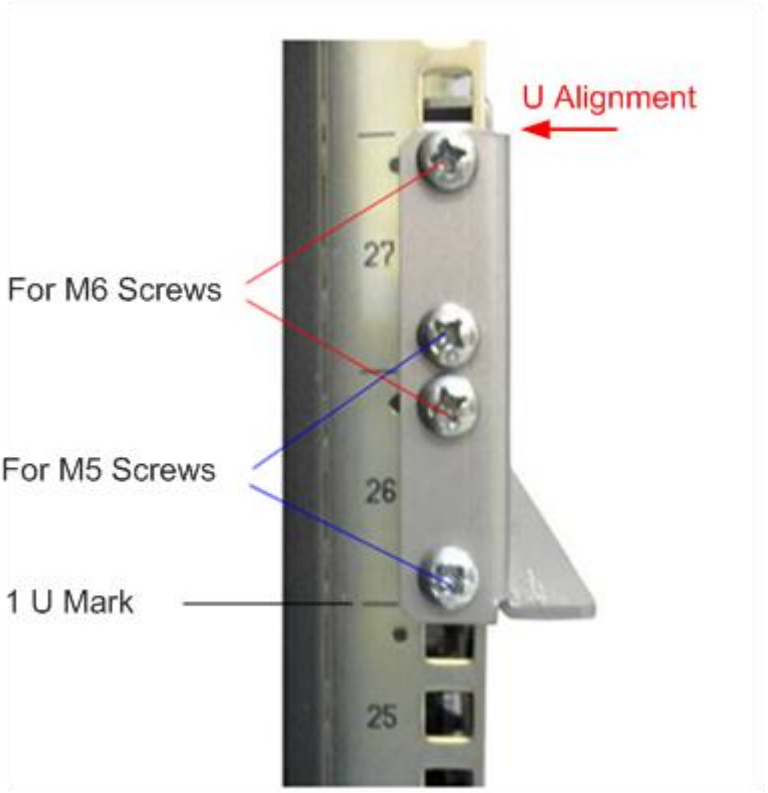
2. Select the round holes in the bracket.
3. Assemble the rail with flat washers, spring washers, and nuts.
4. Do not tighten the screws at this time.

Figure 21: Right Rail Assembly (top) and Left Rail Assembly (bottom)

2. Align the rail mounting holes with the mounting holes in the equipment rack as displayed previously.

    1. Position the rail brackets in alignment with the 1U mark on the Rack. Note: you can install any equipment adjacent to the rail kit as long as you align the rail kit with the "U" mark.

Figure 22: U Alignment



2. Attach the front side of the rail to the rack's front vertical side rail with 2 screws and the rear side of the rail to the rack's rear vertical side rail with 2 screws.

The following figure shows the left rail completely assembled and what it looks like when it is attached to the rack.

3. Go back and tighten the screws that were used to connect the two parts of the rail in Step 1.

   IMPORTANT: If you do not tighten the screws, the chassis cannot be mounted safely in the rack.

4. Repeat steps 1 to 3 to assemble the other rail and mount it on the other side of the chassis; the rails are now ready for chassis installation.

   IMPORTANT: Ensure box-to-box vertical alignment in all four connections. See that the bottom side of the rail is aligned with the 1U marking on the rack rail.

6.3 Mounting the 4700 in a Rack (Standard Installation)

This section provides instructions on how to mount the 4700 in a rack.

Screws and clip nuts to connect the chassis to the rack and rail kit to rack are not supplied by Mellanox.

Make sure that the grounding stud is installed before performing the steps below (see Chassis Grounding (on page 48)).

Prerequisites:

- Rail kit
- 19" bracket attached to the chassis

➢ ***To install the 4700 chassis:***

1. Lift the chassis using a hydraulic chassis lift (or another adequate tool) and place it on the rails, with front of the chassis towards you, as shown in the figure below.
2. Slide the chassis into place. Note: At least two people are required to perform this operation.
3. Secure the chassis onto the rack by aligning the holes in the front of the chassis with the mounting holes in the equipment rack's vertical front rail.

4. Secure the chassis through the holes in the Front Rack rail using 16 screws (8 for each side) and adequate clip nuts, as shown.

5. To stabilize the chassis for transport, secure the 4700 chassis onto the rail by using three 8-32 screws, 3/8" tooth washers, and flat washers, insert them into the oval holes and the threaded holes in the chassis side walls (see Figure 6-10).

Once the rack is installed on the premises, these screws should be taken away so that you can remove the chassis in case the sides of the rack are not accessible.

Figure 23: Securing the 4700 Chassis for Transport - Regular Configuration

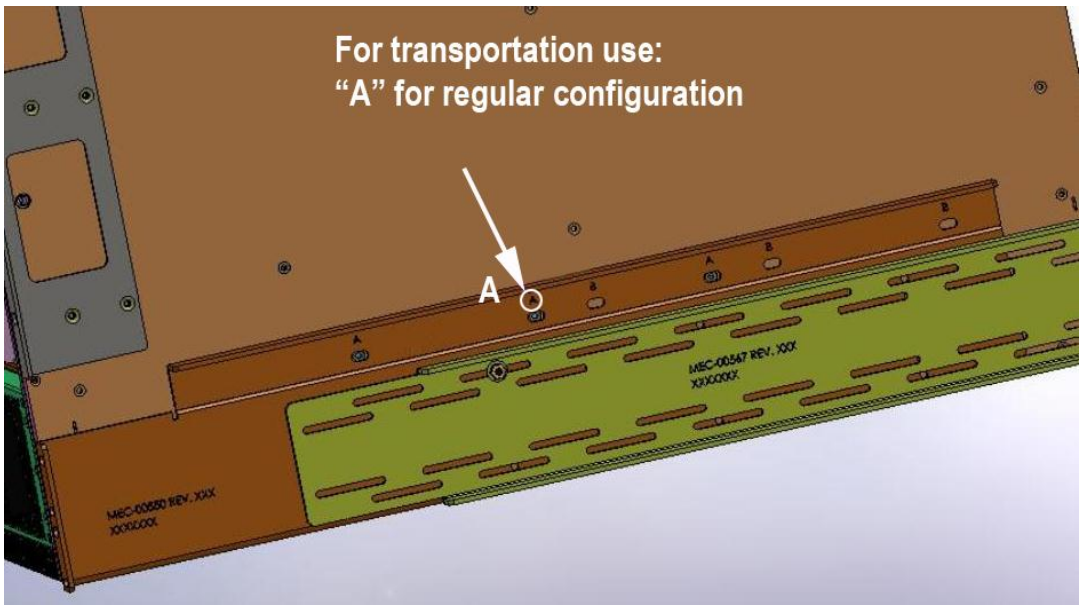
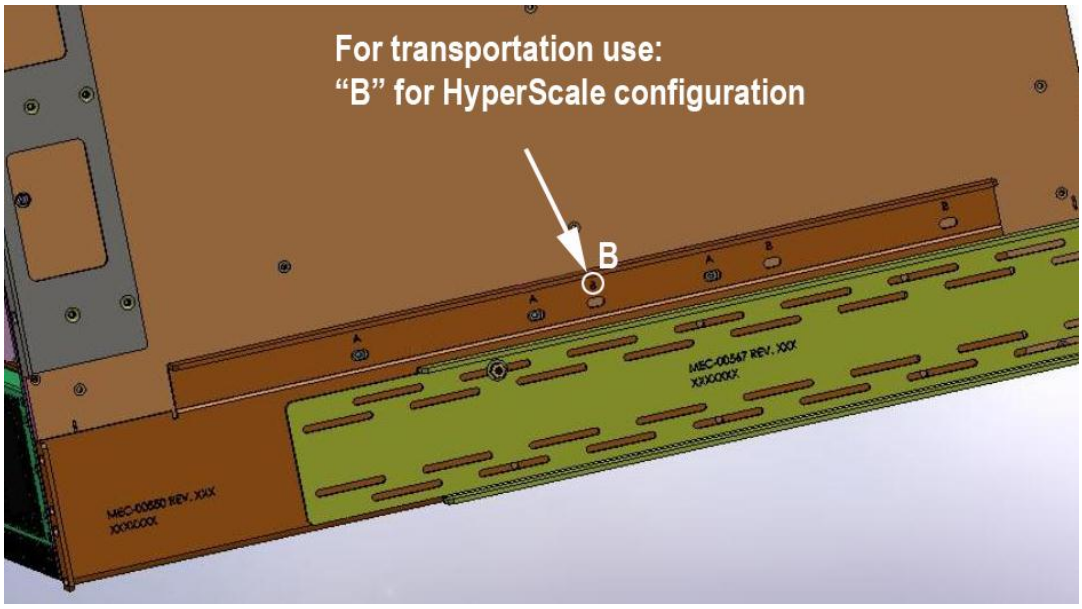


Figure 24: Securing the 4700 Chassis for Transport - HyperScale Configuration



6.4 Mounting the HyperScale Chassis in a Rack

The installation kit includes:

- Rack mount bracket for recessed installation supporting cabling from both sides
- HyperScale cabling guide bracket [for CXP cables]
- Screws (you will need to save the screws from the original brackets + use screws from the kit)

➢ ***To mount the HyperScale 4700 chassis into the rack:***

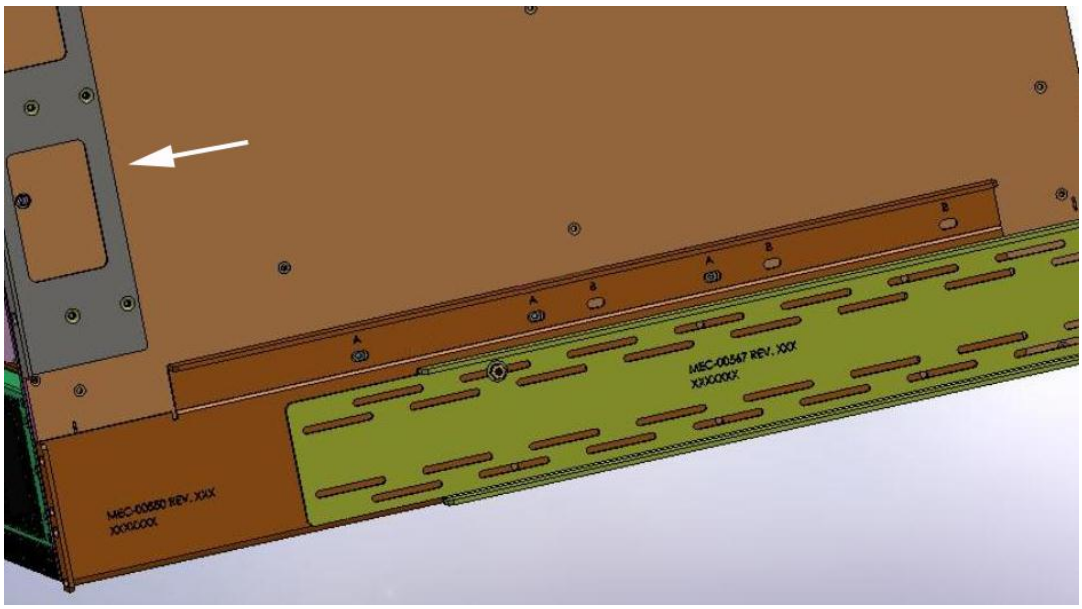
1. Install the rail kit, as described in Assembling and Mounting the Rails (on page 54).
2. Swap the standard 19-in rack mount bracket with the 19-in long bracket (provided in the kit) using the screws from the unmounted the 19-in bracket and screws from the kit (see Figure 6-10)

   If the chassis is installed, disassemble the original 19-in rack mount brackets from the chassis, and assemble the 19-in long bracket. Note: Count five slots to the left of the HyperScale cabling guide bracket and then install it.
3. In the front of the rack, Install the HyperScale cabling guide bracket under the rail kit (as decribed in Chapter 9 (on page 77)).
4. Mount the chassis in the rack (as described in Assembling and Mounting the Rails).

   Note: it is important to leave enough space in the rack for the second 4700-X2 chassis.
5. In the back of the rack, install the regular cable management (as described in Chapter 9)
6. Secure the chassis onto the rack:
   1. Align the holes in the front of the chassis with the mounting holes in the equipment rack's vertical front rail.
   2. Secure the chassis through the holes in the Front Rack rail using 16 screws (8 for each side) and adequate clip nuts.
7. To stabilize the chassis for transport, secure the 4700 chassis onto the rail by using three 8-32 screws, 3/8" tooth washers, and flat washers, insert them into the oval holes and the threaded holes in the chassis side walls (see Figure 6-10).

   Note: Once the rack is installed on the premises, these screws should be taken away to allow chassis removal in case the sides of the rack are not accessible.

Figure 25: Installing the 19-In Long Bracket



6.5 4700 Power-Up

Once the 4700 chassis is secure within the rack, electrical cables from the power distribution source can be fitted in preparation for connection.

Power cords are supplied by Mellanox according to the system configuration, one per power supply unit.

Verify that you have the correct number of power supply modules installed.

1. Ensure that all site power and grounding requirements have been met before connecting the chassis to a power source.
2. Before turning on the power, verify that all boards, power supplies, and fan tray modules are properly inserted.
3. Connect the power supply cords to the AC connectors located at the rear of the chassis.

All LED indicators on the Fabric Board and Line Board briefly light up and then turn off just after power is turned on. This is a normal part of the power on initialization sequence.

After initialization is completed, the link LED indicators on the Fabric Board and Line Board are in a state representing the link status of their corresponding ports.

If there are not enough sPSUs installed, the system won’t power up or in some cases, only part of the system will power up and other parts will remain unpowered.

Determine the minimum number of PSU required and to add at least 1 PSU as redundant (N:1) or full redundant (N:N), using the method described in Power Data per Module.

7 Installing System Boards

7.1 Chassis Board Configuration

Boards must be installed in their designated slot to enable their full functionality. All boards are hot swappable and therefore can be inserted and extracted without turning off electrical power on the 4700 chassis.

The 4700 chassis is factory pre-assembled with fan units. Additional boards and modules are shipped according to the system configuration and are added during installation. Refer to System Configurations **(on page** 18**)** for a list of the possible chassis configurations.

Every slot that is not populated with a module must be covered with a blank panel for proper cooling.

7.1.1 4700 Chassis

The front panel of a Grid Director 4700 includes:

- Nine slots for Fabric Boards (sFB)
- sFU-40H horizontal fan unit
- sFU-40V vertical fan unit

The rear panel of a Grid Director 4700 includes:

- 18 slots which can be filled with line boards (324 ports)
- Two slots for management boards (sMB)
- Six bays for power supply modules (the power supplies can be installed in any of the bays, without restriction)

See Mellanox Grid Director™ 4700 Overview (on page 10) for illustrations of front and rear panels of a fully populated 4700 chassis.

7.2 Inserting/Extracting Boards

When handling electronic boards, wear grounding wrist straps to avoid ESD damage to the card. Do not touch the Midplane with your hand or any metal tool, or you could shock yourself.

Fabric boards, management boards, and line boards have ejectors that lock the board in place and serve as levers for seating or extracting.

- The ejectors snap inward to lock the board in place.
- Two screws on each board complete the seating and lock of the board in place.

The following figures illustrate the ejectors action (the photos below are of the previous design; the new design has **black plastic covers**).

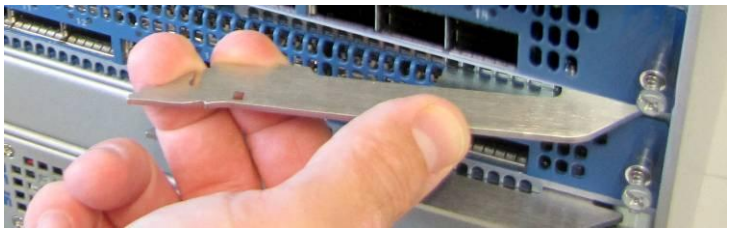
Line Board

Press the ejector inward on both ends of the Line Board.

Figure 26: Using Ejectors to Install a Line Board

Pull the ejector outward on both ends of the Line Board.

Figure 27: Using Ejectors to remove a Line Board



It is recommended to insert boards from top to bottom, starting from slot 1 down to 18.

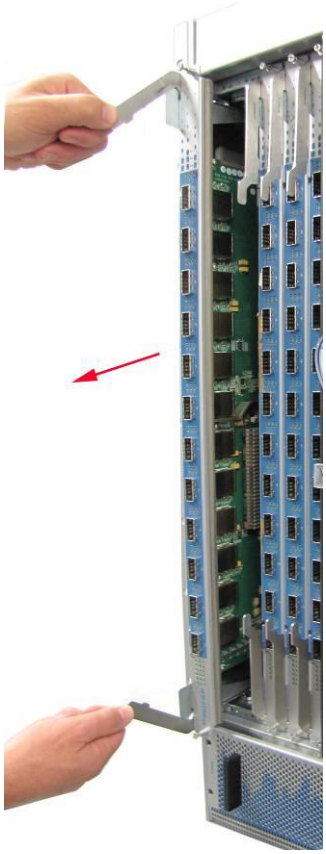
Fabric Board

Press the ejector inward at the top and at the bottom of the Fabric Board.

Figure 28: Using Ejectors to Install a Fabric Board

Pull the ejector outward on both ends of the Line Board.

Figure 29: Using Ejectors to remove a Fabric Board



The ejector mechanism on the Management Board (sMB-CM) is the identical to the one used on the Line and Fabric boards.

- It is recommended to tighten the two board screws before starting to operate the system Refer to Torque Settings for torque specifications.
- When inserting the screws, make sure that they are inserted directly into their groove and that they slide in easily. It is recommended to start the insertion manually to ensure that the insertion is correct.

When using an electric screwdriver to fasten the board screws in place, do not use more than Torque 3 force as this could damage the screws.

7.3 Installing Fabric Boards

Up to nine fabric boards can be installed at the front of the 4700 chassis to achieve a fully non-blocking system.

Refer to LED Indicators (on page 31) for a comprehensive list of LEDs, LED description, and functionality.

➢ ***To insert a Fabric Board into the chassis:***

1. Verify that the ejectors are fully opened.
2. Carefully seat the board into the side guide rails.
   - Slowly slide the board into the chassis until the module guide pins engage the chassis.
   - The ejectors begin to engage the chassis and start moving.
   - When sliding in the board, push from the center of the board front panel and not by pushing the ejectors.
   - Make sure that the front panel of the Fabric board is completely vertical, is pushed all the way in and is leveled with the front panel of the chassis.

3. Gently press the ejectors inward.
4. Tighten the two security screws.
5. Verify the following LED conditions:
   - Power LED: ON
   - Info LED: OFF
   - Rdy LED: Starts to blink slowly

➢ ***To extract a Fabric Board from the chassis:***

1. Release the security screws.
2. Pull the ejectors outwards and slowly slide out the board.

7.4 Installing the Line Board (sLB-4018)

Up to 18 Line Boards (sLB-4018) can be installed at the rear side of the 4700 chassis.

There are 18 external QSFP ports, all in one row, and 18 internal ports on each sLB-4018. There are no "upper" or "lower" rows.

The InfiniBand ports are numbered from 1-18 (from left to right).

Figure 30: Front Panel of the sLB-4018 Line Board

For more information, see LED Indicators (on page 31) and System Cabling (on page 77).

When installing the line boards, start at the bottom of the chassis and work your way up.

➢ ***To insert a Line Board into the chassis:***

1. Carefully seat the board into the side guide rails. Slowly slide the board into the chassis until the ejectors begin to engage on the chassis edge. Do not exert excess force on the connectors when inserting the Line Board.
2. Push the ejectors inwards.
3. Tighten the two security screws.
4. Verify the following LED conditions:
   - Power LED: ON
   - Info LED: OFF
   - Rdy LED: Start to blink slowly

➢ ***To extract a Line Board from the chassis:***

1. Disconnect all cables.
2. Release the security screws.
3. Pull the ejectors outwards and slowly slide the board out.

7.5 Installing the Management Board (sMB-CM)

You can either install one or two sMB-CMs in the back of the 4700 chassis.

Figure 31: Front Panel of the Management Board

The Management Board provides one RS-232 port and one Ethernet port for management capabilities.

At a given time, only one sMB-CM Management Board can operate as a master (active) while the other board is in standby mode (passive).

Refer to LED Indicators (on page 31) for a comprehensive list of LEDs, LED description and functionality.

➢ ***To insert a Management Board into the chassis:***

1. Pull the ejector to a fully open position.
2. Carefully seat the board into the side guide rails.

   Slowly slide the board into the chassis until the module guide engage the chassis, then the ejectors begin to engage on the chassis edge.
3. Push the ejector inwards.
4. Tighten the two security screws.
5. Verify the following LED conditions:
   - Power LED: ON
   - Info LED: OFF

➢ ***To extract a Management Board from the chassis:***

1. Disconnect all cables from the specific board.
2. Release the security screws.
3. Pull the ejector outwards and slowly slide the board out.

7.6 Installing the Power Supply Unit (sPSU-S)

Power supply modules are installed in the rear of the 4700 chassis. Ideally, each power supply module line cord should be connected to a different circuit for maximum fault tolerance in the event of power problems.

Refer to the Regulatory Compliance and Safety Reference Manual before connecting the power supplies to mains.

Figure 32: Front Panel of the Power Supply Module

➢ ***To insert a power supply unit into the chassis:***

1. Carefully seat the unit into the designated slot. Slowly slide the unit into the chassis until the unit is completely engaged on the chassis edge.
2. Tighten the screws.

- Verify that you have the correct number of power supplies installed when powering up the system. Using fewer than the required power supplies for your specific configuration can cause malfunction.
- All power supplies must be powered simultaneously. If not powered simultaneously, the system may not start properly.

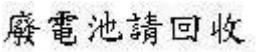
➢ ***To extract a power supply from the chassis:***

1. Disconnect power cable.
2. Loosen the screws.
3. Extract the power supply by pulling the handles.

This product may contain sealed lead acid, nickel cadmium, nickel metal hydride, lithium, or lithium ion battery. The battery must be recycled or disposed of properly. Recycling facilities may not be available in your area. Batteries or packaging for batteries are labeled in accordance with European Directive 2006/66/EC concerning batteries and accumulators and waste batteries and accumulators. The Directive determines the framework for the return and recycling of used batteries and accumulators as applicable throughout the European Union.

For Taiwan:

Please recycle batteries



This mark applies only to countries within the European Union (EU)

This label is applied to various batteries to indicate that the battery is not to be thrown away, but rather reclaimed upon end of life per this Directive.

In accordance with the European Directive 2006/66/EC, batteries and accumulators are labeled to indicate that they are to be collected separately and recycled at end of life. The label on the battery may also include a chemical symbol for the metal concerned in the battery (Pb for lead, Hg for mercury and Cd for cadmium). Users of batteries and accumulators must not dispose of batteries and accumulators as unsorted municipal waste, but use the collection framework available to customers for the return, recycling and treatment of batteries and accumulators. Customer participation is important to minimize any potential effects of batteries and accumulators on the environment and human health due to the potential presence of hazardous substances.

7.7 Fan Units (sFUs)

The 4700 chassis is pre-assembled at the factory with the fan units installed at the front of the chassis. The fan units are hot-swappable modules.

At the system startup, the fan speed is set to turbo mode until adequate temperature is reached. The fan speed is then set to normal mode.

The 4700 hosts a vertical fan unit (sFU-40V) and a horizontal fan unit (sFU-40H). When replacing one of the 4700 fan units, the other takes over and changes to turbo mode, to ensure proper system ventilation.

The 4700 fan units can be replaced within 5 minutes without interruption to the operation of the chassis and without disconnecting it from power.

7.7.1 Vertical Fan Unit (sFU-40V)

The sFU-40V vertical fan unit, shown in the following figure, is part of the 4700 air cooling system; it provides cooling of the Line Boards and the management boards. It includes 5 fans with fan speed control; fan speed is dynamically controlled as a function of temperature.

Figure 33: sFU-40V Vertical Fan Unit Front Panel

Never remove the sFU-40V and sFU-40H at the same time; at least one fan unit must be installed at all times.

➢ ***To replace the sFU-40V:***

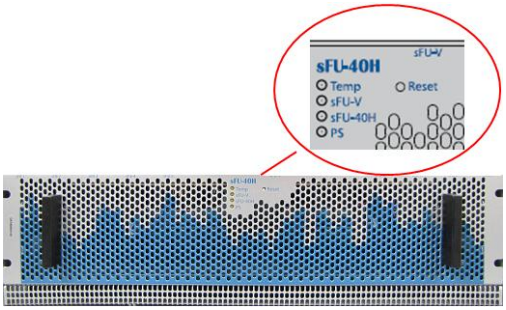
1. Loosen the four screws that secure the sFU-40V to the chassis.
2. Remove the sFU-40V by sliding it out of the chassis.

3. Within five minutes, replace with a new sFU-40V and place and tighten the four screws.
4. Listen for proper sFU-40V fan operation.

7.7.2 Horizontal Fan Unit (sFU-40H)

The sFU-40H horizontal fan unit, shown in the following figure is part of the 4700 air cooling system; it provides cooling of the Fabric Boards. It includes eight fans with fan speed control; fan speed is dynamically controlled as a function of temperature.

LED indications provide an onsite report regarding the operating conditions of the air cooling system modules, and provide an alarm indicator in the event of a high temperature condition.



➢ ***To replace the sFU-40H horizontal fan unit:***

1. Loosen the four screws that secure the sFU-40H horizontal fan unit to the chassis.
2. Remove the sFU-40H horizontal fan unit by sliding it out of the chassis.
3. Replace with a new sFU-40H horizontal fan unit and tighten the four screws (within five minutes).
4. Listen for proper fan operation and check the LEDs.

8 Verifying Installation

Verifying installation of the 4700 consists of making sure that it starts up properly and that the network connections are operational.

8.1 Verifying Start-up Operations

➢ ***To verify that the 4700 starts up properly:***

1. Observe the power supply LEDs on the fans module front panel to make sure the power supplies are operable.
2. Listen and check for airflow to make sure the fan assembly is operating.
3. Observe system LEDs to verify that the system is running and operational.
4. If any of these conditions are not met, refer to Troubleshooting to isolate and if possible resolve the problem.

8.2 Verifying Network Connections

Verifying the network connections consists of making sure that the following network ports are operational:

- InfiniBand
- 10/100/1G Ethernet management

8.3 Where to Go Next

Once you have verified that the 4700 hardware is properly installed, it is ready for optional system configuration.

To configure the system software, refer to *Mellanox Grid Director 4000 Family User Manual*.

8.4 Troubleshooting

8.4.1 Solving Operation Problems

When a startup problem is encountered, it is usually attributed to a single component, which is more difficult to isolate than a problem to a subsystem.

When troubleshooting, we suggest that you start by troubleshooting each separate subsystem in the 4700, since there are fewer subsystems than components.

The 4700 chassis consists of the following subsystems:

- Power supplies that operate whenever system power is connected

- Chassis fan units which operate when the system power is connected. The fan units will not continue to operate when power is disconnected
- Management Board (CLI/Eth)
- Line Board (sLB-4018)
- Fabric Boards (sFB-4700/sFB-4700x2)

The following are simple checks you can make to determine if there is a fan problem:

- Listen to the fan units to determine they are operating
- Check for any obstructions restricting airflow through the 4700

If you determine that the fan is not operating, contact a customer service representative.

8.4.2 Identifying Startup Problems

➢ ***Perform the following steps when you connect the power cord to the 4700:***

1. Listen to the fans operation. If they do not operate, the fans may need to be replaced. Continue to Step 2 to determine if the power supplies are operational. If you determine that the power supplies are functioning normally and that the fans are faulty, contact a customer service representative. If the 4700 fan does not function properly at initial startup (there are no installation adjustments that you can make), contact a customer service representative.
2. Check the power supply LEDs on the rear panel. The power LEDs illuminate immediately upon the connection of power to the 4700. If the LEDs are not on, the power supplies may need to be replaced.
3. Check the Link LEDs on the Line Boards front panel for the various ports.

   In the event of a system lock-up in the Mellanox 4700, the reset button can be used to reset and reboot the system. The system has two Reset buttons: one is located on the front panel of the sFU-40H horizontal fan unit, and one on the sMB-CM management board panel.

   To reset the switch, push the button using a thick wire or tip of a pen until the system reboots. Remove the wire or pen immediately afterwards.
4. Verify that the PC terminal emulation program is set correctly and that the PC is connected properly to the Console management port if the boot information and CLI prompt are not displayed.

9 System Cabling

9.1 Cabling Guide Brackets Installation on Either Sides of the Chassis (Line Boards Cables)

The 4700 cabling guide brackets are installed at the rear of the rack, in-line with the Line Boards and are designed to accommodate adequate cable bend radius.

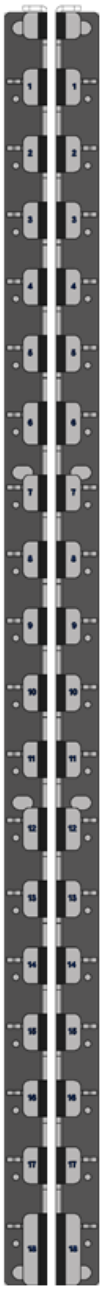
The cabling guide brackets are part of the basic chassis configuration.

- Selecting the optimal InfiniBand cable length depends on the overall cluster configuration and requires proper planning to produce orderly and maintainable cabling.
- HyperScale cable guide requires an additional 1U of rack space, making the total height 20U instead of 19U.

- The 4700 space in the Rack should be free from obstructions such as power strips.
- The rack mounted cabling guide bracket should be installed with its bend facing out, otherwise it will prevent Line Boards from being inserted or removed.
- It is recommended that the rack rails that overlap with the 19U of the 4700 chassis are free of PDU and power inlets.

The 4700 cabling guide brackets are illustrated in the following section.

9.1.1 Installing Cabling Guide Brackets



Left and Right brackets are marked "L" for left and "R" for right. When installed, make sure that the grips face out.

The rack-gripping brackets shown, are installed on the 4700 rack's rear rail.

➢ ***To install the rack-gripping cabling guide brackets:***

1. Install the cabling guide brackets at the rear of the rack itself, on the rail, and not on the 4700 chassis. It is not important from the cable management perspective where on the rack the 4700 is installed.
2. Install the cabling guide brackets in parallel with the 4700 chassis so that each Line Board lines up with its corresponding hanger on the bracket.

9.1.2 InfiniBand Cabling on Either Side of the Chassis (for Line Cables)

It is recommended to dress the cables connected to the InfiniBand connectors of each line board into two groups, left and right, and fasten them down gently after connectivity has been verified.

The cables from the same half of the line boards are bundled on the corresponding hangers and will be routed down along the rack side wall.

Cables should be arranged so that each line board's cables do not interfere with the neighbor line board insertion or removal.

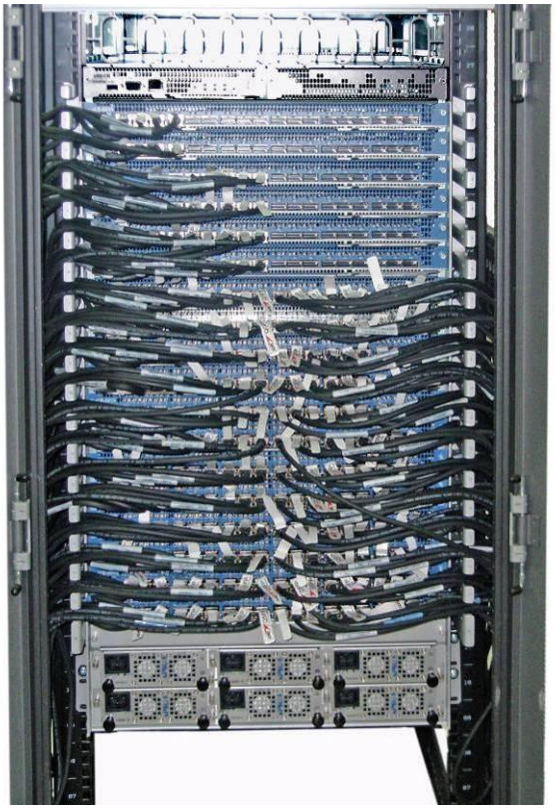
➢ ***To connect an InfiniBand cable to an sLB-4018 Line Board:***

1. Route the cable to the nearest cabling guide bracket hanger position.
2. Position the InfiniBand cable connector with the pulling tab at top, and push the connector in place.
3. Verify that the cable is inserted properly into the connector by gently tugging the cable; verify that the Link State green-colored LED lights (and does not flash) indicating a good physical connection.
4. Gently fasten in place with Velcro tie or tie wraps.

- Avoid using tie wrap guns or similar tools; do not fasten the InfiniBand cable too tightly, as this may cause irreversible damage to the cables. Tie wraps and zip ties can damage the cables. Velcro tie is the recommended option.
- Do not bend the InfiniBand cables too sharply. The recommended minimum bend radius is 4" (10 cm).

The following figure shows the 4700 cable dressing:

Figure 34: 4700 Cable Dressing



9.2 Cabling Guide Brackets Installation under the Chassis (Fabric Board Cables)

HyperScale cabling guide bracket are installed at the front of the rack, between two preinstalled switches. The bracket is designed to accommodate adequate cable bend radius.

The cabling guide bracket is part of a kit for setting up a 648-port configuration.

Selecting the optimal InfiniBand cable length depends on the overall cluster configuration and requires proper planning to produce orderly and maintainable cabling.

- The 4700 space in the Rack should be free from obstructions such as power strips.
- It is recommended that the rack rails that overlap with the 19U of the 4700 chassis are free of PDU and power inlets.

Figure 35: HyperScale Cabling Guide Bracket for Switches with HyperScale Fabric Boards (sFB-4700X2)

9.2.1 Installing Cabling Guide Brackets for Switches with HyperScale Fabric Boards

The HyperScale chassis must be pre-installed in the rack with the 2 x 19" long bracket.

The cabling guide bracket for HyperScale Fabric Boards is installed on the 4700 rack's front rail, in a horizontal position, in parallel and between two HyperScale switches.

- ***To install a cabling guide bracket for HyperScale fabric boards:***

  Install the cabling guide bracket at the front of the rack, under the rail kit, on the rack itself between the two 4700 using four screws to secure the bracket in place.

Figure 36: Cable Management for Switches with HyperScale Fabric Boards

9.2.2 Connecting the InfiniBand Cable between Fabric Boards

- ***To connect a cable between Fabric Boards:***

1. In a Fabric Board installed at the top chassis, position the InfiniBand cable connector with the pulling tab at top, and push the connector in place.
2. Route the cable straight down to the nearest cabling guide bracket hanger position.

3. Select a Fabric board in the bottom chassis and position the InfiniBand cable connector with the pulling tab at the right of the cable, and push the connector in place.
4. Verify that the cable is inserted properly into the connector by gently tugging the cable; verify that the Link State green-colored LED lights (and does not flash) indicating a good physical connection.
5. Gently fasten all cables in place with Velcro tie or tie wraps.

- Avoid using tie wrap guns or similar tools; do not fasten the InfiniBand cable too tightly, as this may cause irreversible damage to the cables. Tie wraps and zip ties can damage the cables. Velcro tie is the recommended option.
- Do not bend the InfiniBand cables too sharply. The recommended minimum bend radius is 4" (10 cm).

The following figure shows cabling between two 4700 installed back to back for a 648-port configuration:

Figure 37: Cabling Dressing between Switches Installed Back-to-Back

9.3 InfiniBand Cabling Guidelines

It is recommended to dress the cables connected to the InfiniBand connectors of each sLB into two groups, left and right, and fasten them down gently after connectivity has been verified.

The cables from the same half of the Line Boards are bundled on the corresponding hangers and will be routed down along the Rack side wall.

Cables should be arranged so that each Line board’s cables don’t interfere with the neighbor Line Board insertion or removal.

9.3.1 InfiniBand Cabling—Do's and Don'ts

Do not kink the cable.

Do not over-bend the cable behind the connector.

Do not twist the connector.

If it is necessary to re-orient the connector, start the adjustment further down the cable, at least 75 cm away from the connector, so the twist occurs gradually along the cable instead of abruptly near the connector.

9.4 Replacing Line Boards

If the cabling is done according to the guidelines described in the InfiniBand Cabling guidelines above.

sLB-4018 Line Boards can be replaced without interfering with traffic of operation of adjacent Line Boards, even when the 4700 is fully populated with Line Boards.

It is permissible to connect and disconnect InfiniBand cables while the 4700 is powered on.

- ***To replace a Line Board:***

1. Carefully remove the InfiniBand cable connections from the Line Board connectors (located at the rear side of the chassis). It is recommended to gently secure the removed cables using a Velcro tie, neatly placing the cables on the outside of cable guide bracket rails.
2. Remove a Line Board, as described in Inserting/Extracting Boards.
3. Insert a new Line Board as described in Inserting/Extracting Boards.
4. Replace the cable connections.

9.5 Connecting to the Management Ports

The Mellanox 4700 has management ports located at top back of the 4700. This includes two interfaces: a serial interface for local console access and a 10/100/1G Ethernet interface for network access. The serial port can be used to connect to a PC running terminal emulation software for 4700 management tasks. The Ethernet port is connected to an IP network and is used to run a CLI (via Telnet).

It also includes a USB type A connection (One USB 2.0 Host interface allows you to increase the CPU flash memory by a connection to a standard Disk-On-Key device.).

Through the management network, you can manage the 4700 using a Command Line Interface (CLI). Refer to the relevant User Manual for more information.

If the configuration calls for out-of-band management of the 4700, either using a serial connection or over Ethernet, the management network must be connected to the corresponding

management ports on the rear of the Chassis. Both types of management network can be connected simultaneously.

- ***To connect to the Management port Ethernet Interface:***

1. Connect the end of the management cable with the single RJ-45 connector to the Management port on the 4700.
2. Connect the end of the cable with Ethernet connector to the appropriate devices/network.

- ***To connect to the Management port Serial Interface:***

1. Connect the end of the management cable with the single RJ-45 connector to the Management port on the 4700.
2. Connect the end of the cable with the DB-9 serial connector to a PC or a console. The PC/console must support VT100 terminal emulation and should be equipped with terminal emulation software such as HyperTerminal or ProComm Plus.
3. Make sure that your PC/console terminal emulation software is configured to communicate with the 4700 via hardware flow control. Configure the baud rate and character format of the PC terminal emulation program to match these RS-232 management port default characteristics:
   - 38,400 baud
   - Eight data bits
   - One stop bit
   - No parity
   - Flow Control – None

Appendix A: Cabling Information and Specifications

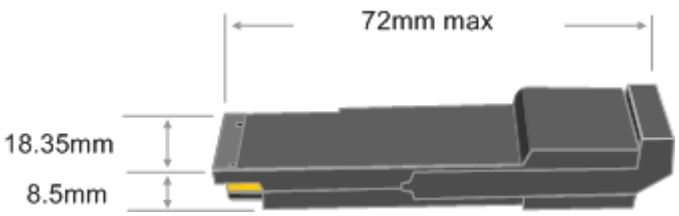
This appendix provides supplemental information and specifications.

A.1 QSFP Cable

QSFP (Quad Small Form-factor Pluggable) Key Features:

- Small size, high density, hot-pluggable connector with four transmit and four receive channels
- Supports both types of cables:
  - Copper active or passive cable
    - Copper passive cable equipped with two simple passive connectors and a standard copper cable
    - Copper active cable equipped with an active device to optimize signal quality
  - Fibre optic cable delivered as either:
    - Fibre cable with two separate modules
    - Active optic cable where cable and optic adaptors are delivered as a single unit (permanently attached cable)
- Data rate: 2.5 Gbps (SDR), 5 Gbps (DDR), and up to 10 Gbps (QDR) per channel
- QSFP optic modules use standard MPO parallel 12-fibre jacketed ribbon optical connector
- Provide manageability, discovery, and identification capability, such as vendor identification, module part number, serial number, cable type, using low-speed two-wire (I2C) interface
- Active cables: Integrates digital diagnostic capability to monitor link performance
- Latching mechanism
- Physical dimensions:

Figure 38: QSFP Connector-Dimensions



QSFP to CX4 cables are available to connect 4700 equipped with QSFP with legacy DDR/SDR systems equipped with CX4 connectors.

QSFP Cable Overview

Every 4700 port on the switch is equipped with transmit and receive circuits that can adjust to fit different types of link characteristics and either optical or copper cables.

The QSFP cables transmit and receive up to 10 Gbps per channel (total: up to 40 Gbps per port) over a single active/passive optical or copper cable, Passive copper cables do not consume any additional power while active copper and optic cables consume up to 2.5 Watt.

You can use the QSFP module with Copper or Optical cables. You can install any combination of the cables in any of the QSFP cages.

A.2 IB Port Cable Specifications

The following table details the cabling specifications for the 4036E 4X InfiniBand ports.

Table 33: 4X InfiniBand Port Cabling Specifications

Type	**Maximum Cable Length**			
4XQDR	**AWG**	**Length (ft.)**	**Length (m)**	**Mellanox P/N**
	26	22.96	7	CBL-00158
	26	16.4	5	CBL-00086
	30	9.84	3	CBL-00185
	30	6.57	2	CBL-00084
	30	3.28	1	CBL-00083
	30	1.64	0.5	CBL-00113
4XQDR – 4036E/HCA	26	26.25	8	CBL-00157
	26	22.96	7	CBL-00158
	26	16.4	5	CBL-00086
	30	9.84	3	CBL-00185
	30	6.57	2	CBL-00084
	30	3.28	1	CBL-00083
	30	1.64	0.5	CBL-00113

Type	**Maximum Cable Length**		
4XQDR	**Length (ft.)**	**Length (m)**	**Mellanox P/N**
	9.84	3	New PN (Finisar)
	16.4	5	New PN (Finisar)
	32.8	10	CBL-00102
	49.2	15	CBL-00103
	65.6	20	CBL-00104

Type	Maximum Cable Length		
	98.4	30	CBL-00105
	164	50	CBL-00106
	328.1	100	CBL-00115
	525	150	CBL-00212
	984.2	300	CBL-00200

A.3 1GbE Ports (Management)

Use modular, RJ-45, straight-through UTP cables to connect the 10/100/1000 Fast Ethernet ports to external switches/routers that relay management traffic.

Use modular, RJ-45 cross-connect cables to connect to end systems.

The following figures show straight-through cables and cross-connect cables.

Figure 39: Straight-through Cables

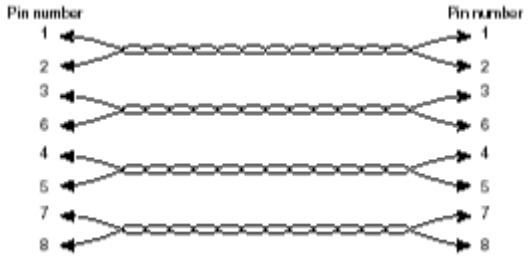
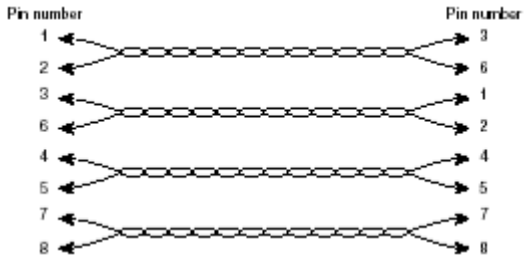


Figure 40: Cross-connect Cables



The 10/100/1000 Fast Ethernet port supports a RJ-45 connector.